TELEPHONE ENGINEER

Volume 30 JULY, 1926 Number 7

OUR FRIEND SOLD HIS HOUSE—AND SOME CONSEQUENCES

Some ten or twelve years ago, a friend of ours realized an ambition of years when he and his little family moved into a new house of modest proportions. Years of planning and saving had gone into that home and although other years of saving would be required before the building and loan association mortgage would be paid off, yet there was a great satisfaction in the owning of the property. As time went on the obligations were met and the home was owned free from all incumbrance.

In the time of acute housing shortage, immediately following the war, an active real estate agent approached our friend and finally succeeded in getting him to place a price on his property. A sale was concluded and a handsome profit was realized—over the amount which had actually been put into the place. The time approached for giving possession and it became apparent that the seller would not find suitable accommodations for rent. He then began a search for other property to buy and found that all available property was being held on the same level as that which he had sold.

Ultimately, he purchased another home but it took all that he had originally put into the first one, plus the profit he had realized on the sale. When the entire transaction was completed he had just what he had started with—a house—and had been put to the inconvenience of moving and establishing his family in a new neighborhood, beside the time spent in his searches. Actually, his profit existed on paper only because it had to be reinvested immediately in property of no greater intrinsic worth than that which he sold.

It seems to us that there is food for thought in this experience for the telephone owner who is receiving offers from various sources for his property. If he expects to stay in the telephone business, he must go to work on a salary which is not very attractive to anyone who has been a successful manager of his own business, or he must look for another property. If he purchases another property, he must expect to find it held at about the same level of price as the one he had sold.

In reaching out for a profit on the sale of his house, our friend overlooked another form of profit that would have come to him in being able to live in a house which cost him less than the current market price. In like manner, the telephone owner to realize a paper profit from the sale of his property often will give up the very tangible profits which may be made by retaining ownership and continuing the operation of the property. One telephone man we know put it this way when discussing an offer that had been made for his company: "If it is good enough for other people to buy at that price and operate, it is good enough for me to keep and operate myself."

GET RID OF THE ACCIDENT REPEATER

Studies by accident prevention departments of telephone companies indicate that the early summer months are productive of more accidents than any other time of the year. A reason for this may be found in the fact that many new and less experienced men are added to the force at this time. These men have not yet received the benefit of accident prevention instructions to the same degree as the older men and, frequently, they do not understand the hazards that are involved in the work.

These less experienced men constitute a hazard not only to themselves but to the older men of the force, for it frequently happens that an experienced and safe workman suffers injury due to some act of the newer men. An added burden is placed on every official, from the management down to the foreman, to see that proper instructions are given and that they are obeyed.

Many accidents are, in themselves, unimportant but a study of the minor accidents frequently gives a line on the accident makers. Occasionally, a man will be found who figures in repeated accidents. He is of the type who never seems to acquire the idea of thinking out the safe way of doing a job. When such an accident-repeater is found on the job he constitutes a menace not only to himself but to his fellow workmen as well. However promising he may be in other ways, he seldom will become a permanently useful member of the force and,

in justice to himself, to his fellow workmen and to the company, he should quickly be separated from the payroll, or transferred to less hazardous work.

KEEPING THE CONSTRUCTION WORK MOVING

With the construction program in full swing, it is essential that there be careful and constant supervision, to see that the work goes forward rapidly and economically. A certain amount of delay is inescapable when storms come, or other unavoidable circumstances arise, but it is a fact that much delay and difficulty can be eliminated by careful planning and attention to detail.

One of the more common causes of inefficient work is absence of proper materials for the job at the time when they are needed. Through lack of foresight, some item of material is not provided, or the stock is allowed to run out. As a result, other work must be taken up until the material can be secured and delivered. Time is lost and the work drags because someone did not plan the work carefully or because complete co-operation did not exist between those responsible for planning, for purchasing and for stock-keeping.

Another cause of delay is lack of adequate information in the hands of the field forces. The foreman meets a condition not covered by specifications and time is lost in referring the matter to his supervisor for instructions. Here, again, the loss is due to lack of careful planning or to close co-operation between the planning and the field forces.

An occasional check-up of the progress of the work, an insistence upon co-ordination of the work of various departments and the placing of responsibility in case it does not progress properly, will do much toward producing a maximum of result with a minimum expenditure of time, effort and expense.

THE MEASURE OF A MAN

These are the years when the Grim Reaper cuts heavily into the ranks of the telephone pioneers. The frontiers they found isolated they left in close contact with the rest of the country. Their work done, their restless spirits move on to that undiscovered bourne.

Life was a fitful fever for them. But in all the stress of building a new industry to alter the course of progress they played the game squarely according to their lights. As they pass their neighbors reflect upon their character and achievements.

One of the typical members of that great and thinning army of telephone pioneers was George H. Rymers of the Northern New York Telephone company. In an editorial lamenting his death the Clinton County News of Plattsburgh, N. Y., made the following comment:

"In the death of George H. Rymers, Plattsburgh has lost a good citizen and the Northern New York Telephone a tried and trusted official, one who could always be depended upon to look after the interest of the organization of which he was a part and do so in a manner which won for the organization new friends.

"No community can afford to lose a citizen of the character and standing of George H. Rymers. Plattsburgh mourns the death of George H. Rymers, always a good citizen and true friend."

TELEPHONE ENGINEER

225 N. Michigan Ave., Chicago.

Vol. 30. July,
No. 7. 1926.

Entered as second-class matter, June 6, 1922, at the post office at Chicago, Ill., under the act of March 3, 1879.

SUBSCRIPTIONS

The subscription price of TELEPHONE ENGINEER is $2 a year in the United States, Cuba and Mexico; in Canada it is $3; in all other countries $4. Single copies, U. S. A., 20 cents.

ADVERTISING

TELEPHONE ENGINEER is issued the 15th of each month. Copy can be accepted as late as the 8th of the month preceding date of publication. Where proof must be seen, allow ample time for transmission in the mails. Display Advertising — Rates on application. Classified Advertising—"Wants," "For Sales," etc.—$4 an inch, or 7 cents a word per insertion.

PUBLIC WOULD SUFFER BY A CHANGE

In an editorial in a New York paper, discussing the recent rate order affecting telephone users in New York City, occurs the statement that there is "little doubt that 8 per cent is to become the standard minimum rate of return until it is shoved higher by judicial philosophy or there is an uprising of protesting sentiment which will compel a different condition of monopoly control. If the public owned the telephone system, it could finance it for 5 per cent or less, write off its depreciation at actual value and bring rates down to a fair coverage of the costs of service."

Without discussing the insinuations with which this statement is packed, attention may be drawn to the supposed advantage of public financing at 5 per cent in the place of private financing at 8 per cent. Nothing is said about the enormous tax revenue which the public would NOT get under public ownership. Neither is it pointed out that the difference between 5 per cent and 8 per cent of the value of the property amounts to roughly about 10 per cent of the income of the telephone system with present operating ratios. Any executive or manager, even if he have no special knowledge of the telephone business, can tell how easily expenses eat up 10 per cent of the income with only a slight loosening of the reins of executive control.

From the standpoint of the public, it would be a fine thing if a governmental agency could give a quality of telephone service equal to that given by private companies and could do its financing at 5 per cent. It likewise would be a fine thing if private enterprise in the telephone business could finance its business at 5 per cent. But what is the use? Things do not happen that way in this great nation, at this stage of its development.

The Problem of Telephone Physics*

By F. I. DOMMERQUE
Fellow A. I. E. E.

13. Sound Waves

The science of acoustics teaches that the sound when emitted by the speaker or by a musical instrument, causes a disturbance of the molecules of air surrounding the disturbing factor or body. When these molecules are set in motion, the air itself remains where it is, but the motion—that is, the disturbance of the air—is propagated in all directions; there are created atmospheric condensations and rarefactions which spread out in the form of wave motion. When these condensations and rarefactions reach the ear of a person standing near to the speaker or the sound emitting instrument they will impinge on the tympanum of his ear and throw the auditory cavities and organs into corresponding vibrations, which are transmitted to the brain by the acoustic nerves.

Sound waves in spreading out in all directions soon become very weak and at a comparatively short distance become inaudible. To transmit speech over long distances, as it is accomplished in telephony, the sound waves are directed into a transmitter, wherein the wave form is impressed on a steady electric current, which will be described presently.

The form of the sound waves is different for different elements of speech. The speech consists of vocal sounds, which are classified as "vowels" and "consonants," both of which are combined into words. In Fig. 9 two waveforms are presented of the simplest kind, one (a) of the vowel sound ōō as in the word "gloom" and the other one (b) of the vowel sound ēē as in the word "bee." Sound waves are rather complex. The sounds of speech do not consist of simple tones, but of the simultaneous combination of a greater or lesser number of tones which are called "partial" tones, since they form the component parts of sound. In Fig. 10 the uppermost curve represents a complex waveform, which is a combination of these simpler waves I, II and III in the figure. These three simple waves form the fundamental elements of the complex wave curve, such elements being called in physics "harmonic" or "sine" curves. The three curves have the same form but differ in two essential aspects, namely in their "amplitude" and in their number of "vibrations." By amplitude is understood the distance of the highest point, that is, of the crest of the wave from its axis, which in this case is the line which divides each wave into equal halves, one-half lying above the axis and the other succeeding half below the axis as can be seen from the figure. We may also say that the amplitude is the greatest ordinate. Furthermore, any ordinate of the complex wave is equal to the sum of the corresponding ordinates of the fundamental wave as can be easily proved by measuring. The crest and the trough, i. e., the positive part of a wave lying above the axis and the negative part lying below the axis, together, make one complete vibration. Thus in Fig. 10 the curve marked I shows two vibrations, the curve II shows four vibrations and the curve III shows six vibrations.

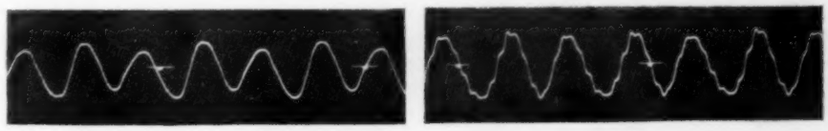


Fig. 9.—Wave Forms of Vowel Sounds (a) oo as in Gloom, (b) ee as in Bee.

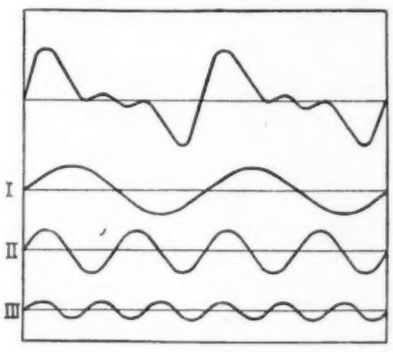


Fig. 10

To form a picture of an harmonic wave, one may observe the wave created by the force of a stone thrown into water. Circular ripples spread out on the surface of the water; a cross section through these ripples would give the picture of one of the waves I, II or III in Fig. 10. Of course, it must be kept in mind that sound waves propagate in all directions, while waterwaves propagate only on the surface of the water. The sound waves propagate in air with a velocity of 1,090 feet per second.

In analyzing sound it has been demonstrated that the partial tones coöperating in the formation of a vowel are superimposed upon the respective fundamental tone, that is, are tones of two, three, four or more times as many vibrations as the fundamental tone. We say the sound consists of the fundamental tone and its "harmonics." It seems almost impossible to analyze the very complicated and abrupt curves composing the vibrations of the consonants.

In the transmission of speech by telephone the quality of sound is characterized by three distinct features: *Pitch, loudness* or *intensity, acoustic color* or *timbre*. The pitch depends upon the number of vibrations per second. The human ear can perceive tones having a range from 16 to 40,000 vibrations per second, which are the extreme limits. The intensity depends on the amplitude and number of vibrations, while the timbre depends on their form.

It is not necessary in telephonic transmission that every sound be exactly reproduced. Intelligibility is not affected by a diminution in loudness. The essential requirement is that the timbre be preserved, and above all that there be no change in consonants. The prime requisite to this end is that the partial tones retain their relative intensity. The more exactly this condition is fulfilled, the more perfectly is the timbre preserved, so that transmitted speech is not only understood but also the voice of the speaker readily recognized. To accomplish this is the problem of telephone physics.

As stated in the beginning, the sound waves when reaching the transmitter impress their form on a steady current. The steady current sent through the transmitter is converted into a variable current possessing the same wave form as that of the speech. The variations of this current are propagated as an electric wave or, more accurately expressed, as an electromagnetic wave, which carries the action produced by the sound wave over long distances to be retranslated into sound waves at the end of its journey.

14. Electromagnetic Waves

Electromagnetic waves are different in

*Fourth article on "Telephone Mathematics and Physics."

character from sound waves. The medium essential for the existence of sound waves is air, and for electromagnetic waves is the ether. The ether is assumed to pervade the entire universe, to be imponderable and coherent, but infinitely elastic.

In general, to call waves into existence requires forces. The force of a stone thrown into water will generate water waves. The expansive forces of a gunshot or the emission of a tone will create sound waves. A disturbance in the ordinary stable state of the ether will bring into being electric forces which make their appearance in vibrations of the ether, that is, in ether waves. Maxwell describes these disturbances of the equilibrium of the ether as an *electric displacement* in the electric field in the direction of the electric force and proportional to its magnitude. This displacement may be considered as a stress and strain in the dielectric, the intensity of which depends on its dielectric constant, the strain being produced by an electric force. (A dielectric is any insulating medium or substance as air, paper, rubber, cotton, silk, etc., surrounding a conductor.)

In addition the displacement current produces inductively a dielectric change in the magnetic field, the magnitude of which depends on the magnetic permeability of the dielectric. This force exerted by the electric current is the magnetic force.

The electric field and magnetic field will not be discussed at this juncture, separate chapters will be devoted to them later on.

If now a sudden change of the electric strain takes place in the dielectric or in the ether, an electromagnetic wave is created similarly to the impact of a stone thrown into water. When the stone touches the water, the latter is depressed at the point of impact; the depression is then followed by an elevation of the surface of the water, depression and elevation following each other in concentric rings setting the water in motion.

A similar relation is established between the electric and magnetic forces when a sudden change in the electric strain is produced. The electric strain corresponds to the water level and the magnetic flux to the motion of the water. A change of electric strain creates a magnetic flux; this magnetic flux in turn creates electric strain, the direction of electric strain being at right angles to the direction of magnetic flux. The electric strain is the component* of the electric force, and the magnetic flux is the component of the magnetic force. The resultant* of the two components is the electromagnetic wave. The direction of the wave is at right angles to the direction of either of the component forces.

In this explanation of the electromagnetic wave we have anticipated some conceptions which will be fully treated in following papers; but it seemed proper to give at this time some information on the electromagnetic wave. The reader may pass it by for the present and return to it after a while when he has learned something about magnetism and electrification.

15. Transmission of Speech

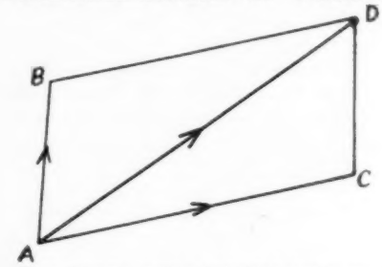
The original telephone of Alexander Graham Bell, which transformed sound waves into electromagnetic waves and vice versa, consisted of an iron magnet bar carrying a coil of very fine copper wire at one end, in front of which was fixed a thin iron disk or diaphragm, the clearance between the head of the bar and the diaphragm being very small. If a current was made to flow through the coil, a magnetic field was generated, magnet bar and diaphragm became magnetic and attracted each other more or less, the attraction being a function of the magnetic intensity of the field.

The word spoken against a diaphragm of such an instrument sets up mechanical vibrations, thereby creating changes in the magnetic field. The changes affect the action of the magnet by causing induction currents to flow in the magnet coil, these currents varying in intensity in correspondence with the vibrations of the diaphragm, the intensity being increased by the approach of the diaphragm to the magnet pole and decreased by its retraction. The intensity reaches its maximum, when the diaphragm passes through its position of equilibrium and its minimum, that is, zero, when the diaphragm attains its greatest deviation from the position of equilibrium at the reversal of direction of its motion.

Suppose the circuit through the magnet coil contains a second coil at a distance, surrounding a magnet bar similarly arranged to the first one, facing a fixed diaphragm; then the electromagnetic waves set up in the sending instrument will cause vibrations in the receiving instrument in unison with the vibrations of the first diaphragm. Such a telephone instrument can be used effectively as a receiver, but not so well as a transmitter, because the diaphragm generates by its vibrations currents of such low intensity that the distance over which such currents would produce satisfactory action upon the receiving diaphragm would be very limited; furthermore, the amplitudes of vibration are rather small on account of the very high speed of the diaphragm. All efforts to increase the amplitudes are made futile by the imperfect elasticity of the diaphragm. Still another disadvantage consists in the variation in reproduction of the speech, the higher tones not being reproduced with uniform strength. A very simple scheme relieves the situation to some extent.

The physical phenomenon that, when two metals or two good conductors are in contact over a small area of their surface or at a point, the resistance offered to a current flowing through the contact is high and causes considerable heating at the contact point, and furthermore, that the heating effect causes an expansion and consequently a small separation of the metals at the contact point, which separation again allows the metals to cool off and to contract again, whereupon the heating and expanding is repeated, and so on, suggests the idea of using such a continuous series of alternate heating and cooling and corresponding vibrating motion of two metals or conducting substances for the transmission of sound. It has been found that carbon properly prepared gives the best results as it possesses a high adhesive quality. Its high adhesion to air creates a condition of stress between the expansion caused by heating and the contraction caused by the adhesion. The electric condition at the contact point, respectively its resistance, is proportional to the pressure exerted upon the bodies forming the contact. The stress depends on the

PARALLELOGRAM OF FORCES



Two forces, acting simultaneously on a body, can be replaced by one single force having the same effect as the two original forces; this single force is called the *resultant* force. The direction and intensity of the resultant force is determined by constructing a parallelogram about the two lines that represent the direction and intensity with which the two forces are acting. In the accompanying drawing the two lines AB and AC may represent the two forces acting simultaneously at point A. The arrow points indicate the directions in which the two forces act and the lengths of A B and A C, drawn to the same scale, represent the intensity of the two forces. Suppose the force acting in the direction AB has an intensity of 27 pounds. To find out whether the parallelo- AC of 46 pounds; chosing a scale of 1/32 inch to one pound, we would make the line AB 27/32 of an inch long and the line AC 46/32 inch, or 1 inch and 14/32 long. We now draw through the point B a line parallel to AC, that is, a line which runs in the same direction with, and keeps at every point the same distance from, the line AC. We also draw through the point C a line parallel to the line AB. The two lines intersect at the point D. Then the line AD is the resultant force in direction and intensity. Measuring the length of AD we find it is 1 28/32 inch or 60/32 inch long; as 1/32 of an inch represents 1 pound, the resulting force would be 60 pounds. To find out whether the parallelogram has been constructed correctly, cut the figure into two parts along the line AD, after you having trimmed it down to its four sides; then you obtain two triangles. Turn the one triangle around and lay it on the other one, and you will find that both are alike in size. The two separate forces AB and CD are called the "component forces" or simply the *components*. The line AD (and also the line drawn from B to C) are called the "diagonals." Conversely, a single force acting in the direction of the resultant may be resolved into two separate forces.

heating of the contact. If the heating becomes too great the electric condition —that is, the conductive effect—is disturbed and the vibrations are distorted; if the heating is insufficient, the adhesion will preponderate. Therefore the pressure at the contact point must be regulated so as to be uniform and sensitive, but not too sensitive, against small changes.

If the current is sent through a contact formed by two carbons, one a disk and the other one a ball, both being in contact between themselves and the ball resting against the diaphragm on the one side and against the disk on the opposite side, ball and disk being suspended so that they can follow the motion of the diaphragm, the minutest vibrations of the diaphragm will cause a change in the resistance of the carbon contact, the change corresponding to the disturbing vibrations, and thus the intensity of the current flowing through the contact and over the line around the magnet of the receiving instrument will be changed proportionally.

An increase in the number of contacts renders the sending instrument or transmitter still more efficient. A very high degree of efficiency, however, is obtained by enclosing a quantity of carbon granules in a chamber formed by two parallel carbon disks well polished, one disk attached to the diaphragm. This arrangement produces a great number of contacts with very small mass of vibrating bodies. The diaphragm can not very well be used as one wall of the carbon chamber on account of its hygroscopic qualities and the difficulty of obtaining a clean and perfectly smooth surface.

With these preliminaries in mind the telephone transmitter may be defined as a sound wave- or vibration-operated device, designed to produce electromagnetic waves or vibrations which correspond in form to the sound waves or vibrations actuating it. The transmitter is the first and at the same time the most important member in the chain that links the voice of the speaker to the tympanum of the ear of the listener. In this transmission of speech the following successive steps may be distinguished:

1. The sound waves strike the diaphragm of the transmitter and cause it to vibrate. The vibrations of the diaphragm have been observed and from these observations the conclusion has been drawn that the telephone diaphragms very accurately respond to the external actuating forces. It also has been found that the amplitudes of diaphragm vibrations are very small, consequently the currents produced are very weak. To produce strong vibrations and to send them over long distances, an induction coil, consisting of an iron core with two windings, is interposed between transmitter and receiver, the primary winding of the coil forming a circuit of low resistance. This circuit is fed either from a local primary battery or from a storage battery common to a number of circuits.

2. The transmitter diaphragm, when vibrating, produces changes in the pressure of carbon contacts, whereby the resistance of the primary circuit is changed correspondingly, which again acts upon the current and electromotive force in the secondary circuit of the induction coil.

3. The induced currents are transmitted over the line to the receiver at the other end of the line.

4. These induced currents produce changes of intensity in the magnetic field of the receiver, whereby

5. The receiver diaphragm is thrown into vibrations starting sound waves which are carried to the ear of the listening party.

The telephone receiver may be defined as an electrically operated device, designed to produce sound waves or vibrations which correspond in form to the electromagnetic waves or vibrations actuating it. In order to obtain an efficient reproduction of the vibrations of the transmitter diaphragm, the partial tones sent out from the transmitter must arrive simultaneously at, and must be reproduced simultaneously by, the receiver diaphragm; that is, the higher partial tones must not be propagated faster or slower than the lower ones. Furthermore, the amplitudes of the waves generated at the sending end may and will decrease during propagation but they should decrease in proportion. Presupposing a satisfactory line, the receiver must be constructed so as to satisfy the above conditions if not wholly yet sufficiently close to prevent distortion or indistinctiveness of the reproduced speech. Experience based upon theoretical investigations has evolved the bi-polar receiver, which seems to have become the universally accepted standard, as only such parts have undergone a change in late years, as are outside of the physical problems to be solved by the receiver.

16. Line Constants

Telephonic transmission is a problem of wave propagation. All electromagnetic waves are alternating current waves, therefore the study of the transmission problem consists in the first instance in the examination of the influences exerted by certain phenomena upon the propagation of the alternating current waves over the line. The end in view of such studies is to prepare the path of the waves so as to avoid all obstacles which will distort them, and where they cannot be avoided to apply remedies which counteract their disturbing influences.

It may first be stated that the velocity of electric or electromagnetic waves is 300,000 kilometers or 186,000 miles per second, which is the same as the velocity of light. This was mathematically deduced by Maxwell and experimentally corroborated by Hertz. But, while the waves of visible light have a length to be measured in millionths of a millimeter, electromagnetic waves measure from 1/10 to 50 kilometers (1/16 to 30 miles). The "wavelength" is found by dividing the velocity of the wave in meters by the frequency of vibrations in cycles per second. The velocity of light and electromagnetic waves being, as stated, 300 million meters.

The electrical characteristics of a line are resistance, inductance, capacitance and leakance. Every line, whether long or short, has these characteristics, and the wavelength which plays an impor-

The Greek Alphabet

Capital.	Lower Case.	Name.	Commonly Used to Designate.
A	α	alpha	angles, coefficients, constants
B	β	beta	angles, coefficients, constants
Γ	γ	gamma	specific gravity, propagation constant
Δ	δ	delta	density, variation, logarithmic decrement
E	ϵ	epsilon	base of hyperbolic logarithms
Z	ζ	zeta	coefficients
H	η	eta	hysterisis coefficient, efficiency
Θ	θ	theta	angular phase displacement
I	ι	iota	
K	κ	kappa	susceptibility
Λ	λ	lambda	conductivity
M	μ	mu	permeability
N	ν	nu	reluctivity
Ξ	ξ	xi	output coefficient
O	o	omicron	
Π	π	pi	circumference
P	ρ	rho	resistivity
Σ	σ	sigma	capital, summation; lower case, slip
T	τ	tau	time phase displacement
Υ	υ	upsilon	leakage coefficient
Φ	ϕ	phi	capital, flux; lower case, angles
X	χ	chi	angles
Ψ	ψ	psi	angles
Ω	ω	omega	ohm, angular velocity

tant part in any transmission problem is greatly influenced by them. The wavelengths of electric waves of telephonic frequencies are not always the same as for light waves as the velocity of propagation of electrical waves of telephonic frequencies may be anything from 186,000 miles down to a few inches per second, depending on the above-named line characteristics.

The propagation of an electric wave is defined by two constants, of which the "wave length constant" is one; the other one is the "attenuation constant." The energy of the electromagnetic wave is gradually dissipated as it moves along the line, that is, its amplitude becomes smaller. This dissipating action is properly designated by "attenuation." The attenuation must be kept inside certain limits else there will not arrive at the receiving end of the line sufficient energy to reproduce the speech. Of course, the length of the line has a great influence. On short lines the disturbing factors responsible for attenuation and distortion of the wave form have little chance to make themselves felt, but on long lines they may become very troublesome. Attenuation occurs also in the apparatus necessary to effect connection between lines in order to establish communication between any two subscribers, but the line attenuation furnishes the principal part.

In the foregoing pages are indicated the principal factors composing the problem of telephone physics; in subsequent papers they will be investigated in detail and explicitly.

17. Symbols of Physical Quantities

One page 23 there is appended a *table of Greek letters* so frequently applied in physics, with a list of the physical phenomena they usually designate.

Chas. E. Scribner, Famous Inventor, Is Dead

Jericho, Vt.—Next to Thomas A. Edison, the late Charles E. Scribner, who died on June 25 at his summer home, Jericho, Vt., held more patents in the electrical field than any other inventor. He was credited with a total of 441. For 23 years Mr. Scribner was chief engineer of the Western Electric Co. For six years prior to his retirement he was consulting engineer. In his early days, he worked with Mr. Edison and their association resulted in a life-long friendship. The first multiple switchboard to be used commercially were of his design. Mr. Scribner was born in New York but spent the days of his youth in Toledo, where he was educated in local schools.

In 1876 he went to Chicago taking with him his first mechanical invention—an automatic telegraph repeater, where he met the late E. N. Barton, former president of the Western Electric Co.

Northern Indiana at Annual Meet Elects W. D. Daniels President

Lake Wawasee, Ind.—W. D. Daniels, Knox, was elected president of the Northern Indiana Telephone association at its annual meeting held here, June 22-24. The meeting, the largest ever held by this body, also named to office Frank V. Newman, LaPorte, vice-president, and Claude R. Stoops, Nappanee, secretary-treasurer. C. E. Koontz, Bremen and Roscoe Pontius, Rochester, were made directors.

The technical part of the program featured addresses on "Conditions Affecting Plant Operation," by E. B. King of the Indiana Bell and "Benefits of Use of Copper Instead of Iron Wire on Rural Subscribers and Toll Circuits," by R. V. Achatz. An interesting demonstration was part of the King address. Frank Thomas of the Indiana Bell spoke on thrift and employed charts to show the advantages of systematic saving, budgeting and other items.

An operators conference, over which Miss Belle Bernetha presided, brought together a number of Northern Indiana's star operators to listen to many practical addresses. Among the topics covered in this program were: correspondence course of the U. S. I. T. A., the C-L-R method, methods of training operators, co-operation of tributary offices with the toll center, local operating and service complaints.

Henry Barnhart, Rochester, president of the Indiana Telephone association, and Albert Stump, Indianapolis, Democratic nominee for senator, were featured speakers during the meeting. The salesmen's entertainment committee, consisting of George Rodomer, Frank Eldridge and H. W. Hogue, staged one of the merriest and liveliest three day family parties the Northern Indiana association has seen, during the hours that were not in conflict with the business sessions.

Canada's "First Fifty" Is Recorded in Fine Book

Montreal, Que.—"Pioneering the Telephone in Canada," a privately printed volume written by William Patten is one of the most interesting and attractive books that have been put into circulation as a detail of the telephone's semi-centennial. The volume abounds in original notes, photographs and reminiscences among them being a hitherto unpublished account of the telephone by A. Melville Bell.

Vivid sketches of the personalities responsible for the progress of the telephone industry in Canada are presented with such interest and accuracy that the book is a genuine treat to the pioneer, and the present generation as well as a historical document of considerable value.

Indiana to Meet Sept. 21-23 at Indianapolis

Indianapolis, Ind.—Annual convention of the Indiana Telephone Association will be held at the Claypool Hotel here, September 21, 22 and 23. As this event is one of the best attended state sessions, exhibitors and other convention attendants are requested by the association to make early room reservations.

Wolf Point, Mont.—B. A. Barickman, manager of the local telephone exchange, is planning installation of service in the Dowd community near here.

Greenville, Tex.—Greenville Telephone Company has begun construction of a new exchange building to cost approximately $150,000.

F. C. Kuhn, Michigan Bell Chief, Dies

Detroit, Mich.—Franz C. Kuhn, for the past six years president of the Michigan Bell Telephone Company, and prior to that time chief justice of the Michigan Supreme Court, died here June 16, after a brief illness.

"Judge" Kuhn, as the Michigan Bell people affectionately called him, was a power in Michigan business and politics. He resigned from the Supreme Court to resume his law practice, but was prevailed upon to take the presidency of the Michigan Bell. He was 54 at the time of his death, and ever since his student days at the University of Michigan had been active at the lead of any enterprise in which he was engaged. One of the busiest of men of affairs, he still found plenty of time for playing a prominent part in Detroit's social life and to form warm friendships with the many with whom his activities brought him in contact.

He is survived by his widow, a daughter and two sisters.

Thayer Tells Colleges of Manager Production

New York City—H. B. Thayer, chairman of American Telephone & Telegraph Company in the annual conference with representatives of 60 colleges, says "we must provide an adequate supply of trained officials. We must schedule production of general managers as we do the supply of buildings and switchboards."

Good Will Inventory Is Most Important Job

By P. L. THOMSON*

The most important job of the management of public service companies today is the cultivation of a sound public opinion. What people think of you controls your credit and therefore your growth. Engineering, operating and commercial considerations all are secondary to the willingness of the people to use your service at rates which will allow you a fair return and to invest their money in your securities. Moreover, you will ordinarily get from your constituents the treatment you deserve. If they have a wrong idea about the way in which your business is financed or managed or the fairness of the rates you charge them, it is probably your own fault. If these conditions are right, then it is you who are to blame for not having convinced the public of that fact. We have heard many times that the public will be fair if it knows the facts. This puts up to you the responsibility of giving them the facts. The best way to drive out a bad idea is to put a good one in its place.

You public utility executives are likely to be under the fire of politicians or press only so long as they believe that their attacks will win popular approval. Of course, corporation-baiting doesn't offer the same opportunity for political platforms that it used to. The reason is that it doesn't win votes as it used to, and it doesn't sell papers as it used to, because men and women are better informed. But from the very nature of your business you are bound to be subject to unfriendly attacks from time to time, and the answer how to meet such criticism is to give them an appreciative understanding of your business. This, of course, is also the right way to build constructively a permanent and abiding good will on the part of your customers, quite apart from its value as a defense measure against unwarranted attacks.

I step out of my role as one who for more than twenty years has been closely identified with the telephone and electric light and utility field and talk to you through the eyes of a newspaper man, which I was before I entered business and which I have in a sense been during most of these years since. From this angle I am going to tackle your good-will problem backward and see what is ordinarily the basis of the criticism that you get. Then I'll indicate for each type of criticism what seems to me the character of the publicity which best fits as an antidote. Perhaps out of such an examination we may find we have set up a constructive program of confidence building machinery.
—P. L. THOMSON.

Why Do They "Ride" You?

What are the reasons then why people don't like you?

1. **Poor Service.** Fundamentally, of course, indifferent service is the greatest ground for criticism, just as good service is the greatest builder of good will, but if your service is not everything that it should be, I think it is still possible to maintain healthy relations with your customers if you are frank with them and admit your shortcomings. In that respect I don't agree with a recent writer in the Electrical World who says, "You can't have good will unless you have good service."

There may be and frequently are good reasons why you can't give your customers a degree of service that satisfies them or you. Under those conditions you can tell your story frankly and ask the public to be patient. Perhaps you are up against a shortage of plant that couldn't be foreseen, perhaps limitations of your franchise which work a hardship, and you are doing the best job that is humanly possible under the circumstances. I remember some striking telephone and central station advertisements of that character following a breakdown of service after the big storm in New England last year. It told the story of a sturdy equipment built with all the skill that human brains could devise breaking down under the onslaughts of a northeastern storm; it pictured the tireless energy of those faithful employes who were striving against such odds to restore and maintain service. That advertising was timely and it got a quick response from a public that was willing to be patient when they knew what the public service company was up against. And advertising like that, showing the ideals toward which the men and women of your organization are working under such stress, is a great builder of morale among your people themselves.

So my answer to the charge of indifferent service is to remind your customers how dependable your service normally is. Picture electricity as a strong, tireless servant and the army of faithful men and women alert to maintain twenty-four hour service, giving transportation, electric light, power, communication, with equal fidelity to poor and rich, lightening the burden of housewives, enabling the farmer to take advantage of labor and time saving devices, all at a cost insignificant compared with the benefits. For every breakdown in an electric light circuit, telephone line, trolley service, there are a thousand times when the service is correctly performed. Do your customers understand that? If not, then you have overlooked telling them a story that is of perfectly obvious value to you and that is of continual interest to them. Keeping customers sold on the service and merchandise one has to offer is a business policy that has been well understood by manufacturers and retailers for years.

2. **A Monopoly.** As a newspaper writer I fancy I could start something in most any of your home towns by reminding the public that you are running a monopoly. Americans just naturally hate monopoly. They resent the feeling that they've got to do business with anyone whether they want to or not.

But the answer to this charge isn't so very difficult. Just admit it. Only tell about it as one of the features of your business before you are placed on the defensive. You are operating a monopoly because competition in electric lighting and telephone service and other utilities has broken down in practice. What your citizens need is some elementary history lessons. The era of speculation in the financing of the early utilities, the mistakes of shortsighted management who didn't understand about making adequate provision for obsolescence, replacements, insurance, and the like, the ruthless cutting of rates to a point where nobody could make any money, and the public had to put up with poor service or no service at all—these things belong in the past. They represent a stage in the history of public service which has now happily largely given place to the practice of franchises by the state or governing authority for exclusive rights to

Mr. Thomson, who delivered this notable address at the convention of the southwestern division of the National Electric Light Assn., is publicity manager of the Western Electric Co. and past president of the Association of National Advertisers.

operate under the jurisdiction of a Public Service Commission.

With these exclusive rights have come new obligations as to capitalization, rates, franchises, and earnings, and these apply alike to the protection of the public, the companies themselves, and the stockholders. You don't oppose regulation, I fancy, you just insist that it must be fair. If you haven't told this story of how you happen to be in business without competition and why it is a good thing for your customers that you are, then it is no wonder that the word "monopoly" is like a red flag when someone who would do you injury cites it as sinister. And if you have a good advertising department, you can make your story just as interesting as the story of the man who would embarrass you.

3. **Municipal Ownership.** The point about government, state, or municipal ownership is that so much history has actually been made in the unsuccessful efforts to take the management of utilities out of private hands, and the results have been so conclusive that to me as a newspaper man it seems perfectly clear that the way to keep voters from supporting undertakings of this character is to just tell them the facts. Our good friend, Mr. E. N. Hurley, after a notable experience in government service says that we can't expect more than a 50 per cent efficiency out of men in public service. The management by political appointees has invariably proven inferior to management by trained men, and the low rates which we still sometimes hear quoted as having been successfully in effect are ordinarily found to be made up by operating losses carried as taxes and assessed against the general public.

Your business is one that calls for constant development. Remember that it is less than forty-five years since the first commercial electric light service was instituted in New York and the first electrically operated street cars ran in America. The telephone is only fifty years old, and the third rail was first exhibited at the World's Fair in 1893. Yours is a business which calls for constant research and development by highly trained engineering staffs and a management alert to take advantage of every change in the art. It is this constant watchfulness for improvement on the part of these industries themselves quite apart from the urge of competition that has enabled them to make these developments which have so improved the art, kept the cost from advancing anywhere near in the same proportion as commodities generally, and made your service available to increasing millions. To put a highly specialized and technical business of this character into the hands of a political organization would be absolutely fatal to initiative and would be certain to arrest further development. Have you ever told this story to your customers? If you haven't, you are overlooking a good bet.

Up in Pennsylvania, for the second year in succession, the legislature has just vetoed the efforts of the governor to put the state into the electric light and power business. I am sure that that result was largely influenced by intelligent publicity as to what the governor's proposal involved. This was done through the medium of newspapers, through speakers at Chamber of Commerce meetings, and through magazine articles.

Finally, if it is municipal ownership that your critics want, just tell the story of how you have achieved true public ownership through the purchase of your securities by your customers. "Who owns the Centerville Electric Light Company?" is a question which well might be made the subject of an advertisement. And if you haven't pointed out that Jones, the butcher, with a few shares of preferred stock, that Smith, the baker, with an insurance policy in a company that has invested in your securities, and that Brown, the grocer, whose savings in a bank that buys your bonds, are owners of your company—if your customers don't know these things—then you have failed to tell them of one of the outstanding changes in business and finance today—the drift to popular ownership of industry.

No longer is it true that Wall Street owns the utilities. Two and a half million people own the electric light companies. There are three-quarters of a million security holders for the nation's telephone system, and a million people own the stocks of our railroads. Nineteen million people are shareholders in the country's business enterprises as compared with four million before the war. The trouble is that your man on the street does not know these things.

4. **A Cold-Blooded Corporation.** Time was, within the recollection of many in this room when that charge was all too true in the field of American public service, and there are lots of people who don't know about the change. If you would disprove it in your own case, open up and tell your public about your ideals of service and what you are doing to achieve them. Point out as they did so well out on the Pacific Coast who it is that makes up your company—

"Your old schoolmates and friends operate the Pacific Gas and Electric Company.

The officers and managers of this company are boys and girls who have grown up as schoolmates of some of the 600,000 patrons of the company.

When one stops to think about it—that flesh and blood people are working for you and sharing the same thoughts and aspirations as you—a public utility concern doesn't seem so unfeeling and cold, does it?"

You can create a friendly feeling toward yourselves as neighbors of those whom you serve and point out how your growth invariably links up with the progress of the community. Here is the way the Bell Telephone Company of Pennsylvania did it. The title of the advertisement is "Neighbors":

"Your telephone service is in the hands of your neighbors. The men and women who build and operate the telephone lines are a part of this community. They are interested in business improvement and civic betterment because they know the telephone industry must prosper or decline as the community improves or retrogrades.

Like "The butcher, the baker, the candlestick maker," the members of the Bell System Family serve a common need. They understand your telephone requirements and they have the training and the equipment necessary to give you the right kind of service. Whether it be to put the people of this vicinity in touch with each other, or in communication with points from 35 to 3500 miles distant, this organization is on the alert day and night."

And from another one: "The Wealth of Beaver Valley."

"Beaver Valley is one of the most prosperous sections of the United States, but its wealth is not wholly in mines and mills and farms, nor in bank balances and pay envelopes.

Its greatest asset is the happiness of its homes. Its greatest hope is bound up in the children of its schools and playgrounds. Nature gave the region a rich soil, and filled its hills with valuable minerals. The development of these resources has given a livelihood to thousands who are proud of what the valley has accomplished. This development could not have been so extensive without the thousands of telephone lines uniting the residents of the valley with each other and with the rest of the world. No group of citizens in Beaver Valley is more interested in its progress than are those who represent the Bell Telephone System. They are proud of their home communities and are anxious to give their nighbors the best telephone service possible."

So you see, my antidote for the charge of running a soulless corporation is just to open up the soul of your business not alone through your publicity but by encouraging a friendly contact between every employe and the public. The first essential in doing that you will find is to develop better relations between your company and your own people. Far worse than the fellow who criticizes your service is the employe who doesn't know enough about the business to defend it. "I can't tell you. That's in another department," will lose you more friends in a day than paid advertising will make up for in a month. What is it that the

dealer in merchandise wants above all else? The repeat order. Almost any merchant can get a man or woman into his store for a first call. The trick is to get them to come back and to keep on coming back. And you public service men have an almost continuous opportunity for contact with your customers. I wonder if you are making the most of it.

When your employes get the customer's point of view they win his confidence and that confidence is the first step toward securing him as a partner in your business. John Wanamaker and Marshall Field built up their reputations on the slogan, "The customer is always right." Too often in the utility business just because the dissatisfied customer *can't* go elsewhere to buy, you place on him the burden of proving that he isn't always wrong. This is no new thought to you gentlemen. The pity of it is that year after year you come to conventions, applaud a speech like this one, admit the charge, and then go back home and forget it. You are just like the reform party at election time. You get all "het up" over conditions, pass resolutions, and then cool off while the politician keeps plugging away for votes.

Last month in Brooklyn a woman was elected president of a five million dollar corporation, the Brooklyn Borough Gas Company. She is Mary Dillon, a woman only now in her middle thirties who went to work as an office girl in that company twenty-three years ago. A contemporary says of this outstanding rise to executive responsibility, "Mary was alert, energetic, intelligent. She saw other girls get dowdy at their stagnating office work. She saw men grow seedy and bald-headed, take to spectacles and paper cuffs to keep their semi-weekly shirts clean. She herself kept trim and cheerful. In 1919 the gas company workers decided they wanted to strike. Mary talked to them like a mother and also like a "Dutch Uncle." They kept on working. Her ways with the public, with the company's 40,000 customers, were always winning. *She humanized the business.* There is your cue, gentlemen.

Responsibility of the Executive

Better public relations begin at the top. It is you who must instill these ideals of service into your people all the way down the line. That will provide for the day to day contact with your customers as individuals. Then, secondly, must come intelligent and consistent advertising in your newspapers, translating that same company spirit to your customers in the mass. I know of no single means of interpreting a utility to its public so important as the advertising columns of the newspapers in your territory, and I should assume that you recognize the consistent use of this valuable medium as perhaps the first plank in your platform of building confidence. Then in the third place is the contact you should establish with your customers in groups.

Of these first are the editors of the papers in your territory. Do you know them personally? Is your office door open to their reporters? Do you give them the news freely? When there is an accident, don't withhold the facts. Cultivate a spirit of frankness; when service is bad, admit it, and point out how and when you expect to make it better.

Second are the Chambers of Commerce, Rotary, Lions and Kiwanis Clubs, Advertising Clubs and Better Business Bureaus. These are places where your own and your fellow executives faces ought to be familiar and at least once a year there ought to be a meeting devoted to just the subject of public utilities.

Third, church clubs and women's clubs are always on the lookout for speakers on timely subjects relating to your business, and there are films and demonstrations available for this purpose prepared by your association headquarters.

Fourth, there are the grade and high schools where your local manager can ordinarily gain the opportunity for a talk once or more a term, while the teachers' co-operation in essay contests opens up an interesting means for you to get the youngsters to understand your business in their impressionable years.

Fifth, radio broadcasting offers another very fertile field for talks about your business, and I know from experience that they are far reaching in their effects. Last month I had a request for some information on private vs. public ownership of utilities which came from a school principal in Peoria, Arizona. This teacher wrote that she had heard an address of mine on public utilities given on the radio from the station of the Kansas City Star. That talk, gentlemen, was in March, 1924, a full two years before.

Sixth, in the colleges and universities in your territory are courses of study on economics where young men are studying the principles of corporation finance and management—the very elements of your business. Invite these institutions to use your companies as laboratories and thus help these boys to the right grounding in the utility business. It is claimed that many of these institutions with theorists as instructors are the incubating ground for Socialists and Communists who go out into the world preaching government ownership and other half-baked ideas. I know that is true because I was one of these birds myself. Yes, sir, at my graduation I won a prize for an oration entitled, "Public Ownership—the Answer to the Trust Question." And I've been trying to live that down for twenty-five years! The way to forestall that sort of influence is to get yourself appointed to the lecture staff of these institutions and start these young men off thinking sraight.

Finally, get a good publicity man, preferably a newspaper man, to direct your public relations. He will realize the necessity for doing these things before you are forced to. Don't think because you're "sitting pretty" right now, you don't need to advertise. Don't wait to start your campaign for confidence until the confidence has already been lost. Do it first. And the next thing is to keep it up. You can no more have a campaign to build confidence than you can have a breathing campaign. Your public relations are being formed for good or for ill every hour of the day. During the week that you will be down here at Galveston (the convention meeting place) 3,190 of the folks you have been educating are going to die and 6,380 new customers are going to be born. You will have to start right in educating this new bunch because some of them may be public service commissioners forty years hence.

In this connection I must add a word of praise on the fine progress which has been made by the utilities in the organization of State Public Information Bureaus, of which your own association has some outstanding examples. I am familiar with the work which your executive managers are doing, and I commend it as worthy of your support and interest. I hope that every utility in this territory is taking advantage of the service which is offered you by these state bureaus.

Just one word, too, on what the manufacturers in the industry are doing in this general campaign of building good will for the electric light industry. The fact that I am here today is evidence of the recognition by the company with which I am connected that it believes in practical co-operation to bring about the common purpose of better public relations and prosperity for the great utilities which we serve. For more than five years the manufacturers in the electric light, street railway and telephone industry have been using large amounts of space in popular magazines and newspapers to build good will for the utilities. And, speaking for one manufacturer who has spent a great many thousand dollars in this fashion, I feel sure that our investment in this form of publicity has brought and will continue to bring a large measure of return.

I think it was John D. Rockefeller who said, "The next best thing to doing a good job is to let the world know about it." It is too bad that he didn't come to an appreciation of that fact earlier in life because within your memory and mine you have seen the company he founded graduate from almost general public disfavor into being recognized as a most efficient instrument of great human worth.

Toll Line Testing Methods

By E. R. COLLINS
(*Manitoba Telephone System*)

A few days ago a neighboring wire chief called me and asked how to take a certain measurement in testing toll line trouble. It was a test which is very common and with which I supposed every wire chief was familiar. In a recent issue of a telephone magazine there was a request for an article on the different methods of making tests, in a language that would be understood by the average telephone man. Whether this article will be able to measure up to these requirements is doubtful, but the writer is setting down in review, the different testing methods which have been found to be most useful in his experience. It is hoped that the information set forth will be of assistance to some one.

In the field of the telephone worker, there is no occupation quite as fascinating as toll line testing. Did you ever experience this? On a stormy morning, when lines are down, and testing conditions bad, you have measured the location of a very difficult trouble; you have sent the troubleman out into the storm, over terrible roads, and later in the day he has called in and reported O. K. with this remark, "You hit it close that time Bill." There is a feeling of satisfaction which can only be known by experience. And I have found out that the troubleman is about as much pleased as "Bill" was to have the measurement correct. Accurate measurements of distance can be easily made with a little practice, and the exercise of patience and perseverance.

It is not always possible to make an accurate location on account of peculiar line conditions, and sometimes the tester will make an error in his calculations. Mr. Wire Chief, if you do make a blunder, don't try and make out that the troubleman is a liar because his report of the location does not agree with your measurement. If you make a mistake be honest about it. If you are not certain about a measurement, tell the troubleman, so that he may be prepared to find the trouble at some other place. The toll wire chief must work in harmony with all of his troublemen at all times, if good results are to be obtained.

Methods of testing have improved as the demand for more speedy repairs has increased. In the early days the only instrument for testing was the series magneto generator. The distance to the trouble was judged by the sound of the bell and the feel of the generator. It required a great deal of skill to tell the distance, but it was surprising how accurately some men could make locations.

Toll line services today are more heavily loaded with traffic, and the complex services carried over individual pairs of wires has increased their value to such a degree that it is very important to keep them working at highest efficiency. To do this, the toll wire chief is provided with instruments to make accurate measurements of location, and the troubleman is given quick transportation to that location. The time improvement resulting will depend on the extent to which these are used.

Testing Equipment.

The instrument most commonly found for testing is the voltmeter, with its associated keys, cords and batteries. This instrument is usually of the 10,000 or 100,000 ohm type. Such a high resistance voltmeter is needed to detect poor insulation, or for making open locations when properly wired for such work. To measure lower resistances, it is necessary to use a shunt bridged across the voltmeter as shown in Fig. 3.

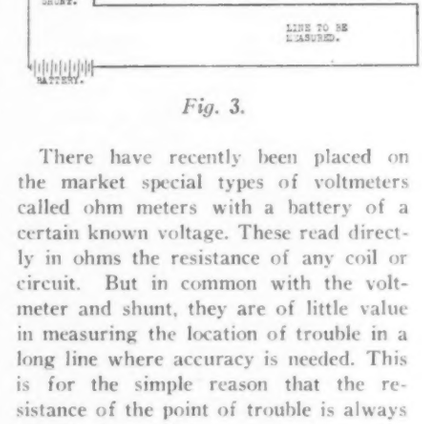


Fig. 3.

There have recently been placed on the market special types of voltmeters called ohm meters with a battery of a certain known voltage. These read directly in ohms the resistance of any coil or circuit. But in common with the voltmeter and shunt, they are of little value in measuring the location of trouble in a long line where accuracy is needed. This is for the simple reason that the resistance of the point of trouble is always an unknown value.

The Wheatstone bridge method is the most dependable for making accurate locations on a trouble on a single wire or a pair of wires. These instruments are put out in a variety of forms, under different names, but the Wheatstone bridge or balance principle is the same in all of them. A good working knowledge of this principle is needed to get the best use of these instruments.

Manufacturers of testing equipment issue instruction books with the instruments. These explain in detail through the use of algebraic formulae, all the uses that can be made of the instrument described. To cover every use requires quite an array of mathematics, and here is where so many telephone men get into deep water. They find it difficult to know which test or formulae to use for certain purposes. And even after the formulae is found the application is sometimes just as uncertain.

Toll Line Records.

To obtain a balance with a Wheatstone bridge, or to read a voltmeter or an ohmmeter, is quite a simple matter, but to convert the reading into miles and feet is often quite a different matter. In testing toll lines, there is no time for guess work or looking up text books or other information. The record of the toll lines and equipment, together with the different testing methods, should be compiled in some system of records for quick reference. These records must be simple, complete, accurate, and easily referred to.

The Bell companies, and many of the larger operating companies, provide standard maps known as wire maps. These give the toll line routes and exchanges in their relative positions. They also give line numbers, size and kind of wire, class of service, and grouping of lines. These maps will vary according to the practice of the company issuing them. So we will only say that every toll wire chief should have the latest copy hung close to his test desk as the first of his records.

Another type of map that is not so common, but is very convenient, is a geographical map drawn to a scale, showing toll lines, exchanges, roadways, rivers and railways in their exact geographical location. The following information of a local nature can be added to great advantage.

1. Railroad and Power Lines.
2. Telephone Lines crossing over or under railroads, power lines, canals or rivers.
3. Sections of Roadway that are impassable.
4. Toll Line Circuit numbers at boundaries.
5. Testing points other than exchanges.
6. Any special or irregular types of construction.

Different lines of Railway or Power Lines can be marked in different colors. The color scheme can be drawn up to agree with a legend in the corner of the map. This will be found much neater than trying to write the names along the road or power line in question. Places where power lines, trolley lines, telegraph

or signal lines, fire alarm or other companies' telephone lines cross toll lines should be marked on the map. This will be found useful information when trying to determine the source of foreign current coming in over a toll line.

At railway or power crossings, some special type of construction is used to avoid dangerous contact with wires carrying heavy voltages, or to meet local regulations. The type of crossing, whether open wire, insulated wire in rings, aerial, underground or submarine cable, should be shown. A record of the type of protectors used on the cable pairs should also be shown.

A cable record of each crossing cable should be kept by the wire chief with his other toll cable records. This record to be accurate, must be checked with the cable at certain times. This means that a cable man or troubleman must inspect the cable boxes. Special emphasis should be given to the condition of the spare pairs. This can easily be done by having the troubleman use a jumper wire connected to a working line, and testing each spare pair from the toll test desk. It is very aggravating to call for a spare pair in a cable, and find the pair in trouble. A routine record of such inspections will prevent these being overlooked.

Toll lines are sometimes built along sections of surveyed highway, which are not fit for vehicle traffic. At such points it is necessary for the trouble man to get out and walk. If the wire chief does not know of these conditions, he is apt to become impatient at the length of time required to reach a certain place. In northern districts roads which are easily traveled in the summer, are closed each winter with snow. Where this condition is quite common, a record should be made on the map with the record of other untraveled sections. When a measurement is made, and plotted on the map, the relation of these sections of road to the clearing of the trouble will quickly be seen. The troubleman can then be prepared for such cases. If in winter he can take his snow shoes along, and also a teamster to look after the horses, if it appears he will have to cover a bad section of the line.

At boundaries of companies, or countries, it is quite common to find the circuit number changed. Record the circuit numbers involved on the map at the boundary. And right here let me add, that the defining of district boundaries should be definitely settled, and marked on this map so that there will be no occasion for dispute over the distance the troubleman will be required to cover.

Individual Line Record.

The next record is of the individual lines. This record should give the complete information of each toll line. It can be compiled in a card system, or a loose leaf system. The loose leaf is much more compact and handy around the test desk. A loose leaf binder 9 ins. by 12 ins. is a very convenient form. The sheets can be typewritten. When changes are made a new sheet can be used to keep the record correct. A sample of a very convenient form of line record is given herewith:

March 31, 1926. **LINE 27.**

Ring	From	Service	To	Miles	Wire
1	Brandon	Term.	Rapid City	21.9	10 B&S Copper
4	Rapid City	Looped	Minnedosa	18.62	10 B&S Copper
1—3	Minnedosa	Term.			
			Total.....	40.52	

Cable. Brandon 3259 ft. Cable 16 ga. Quad.
Rapid City 150 ft. Wire No. 12 B&S B.R.C. both ways.
Minnedosa 135 ft. Cable 16 ga. Quad.

Brandon to Rapid City used with No. 145 to form Phantom No. 107.

On the reverse side a wiring scheme may be sketched in ink or pencil as desired, of the line and its association with other lines. This is often convenient for some of the more complex circuit arrangements. A sample of this is shown in Fig. 1.

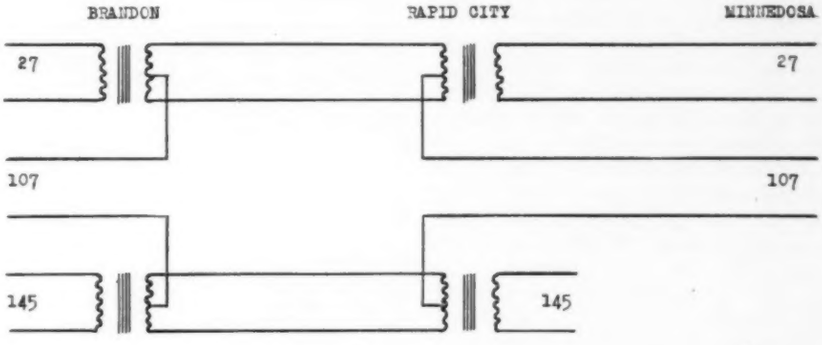


Fig. 1

Record of Exchanges.

Of equal importance with the line record is the record of the testing equipment at small exchanges. At such points it is quite customary to ask the operator to make any connections required for testing toll lines. As operators change very often, it is almost impossible to keep them all informed how to make test connections. To offset this, we must have the apparatus at these points as simple as possible. The wire chief must know what apparatus is there, and how placed. The simplest way to keep this is a picture record of the test box and a record of other equipment. This record can be filed in the loose leaf line record binder, in alphabetical order for exchanges. A sample of such a record is given herewith.

Equipment Designations.

At small test exchanges, there should be provided a short circuit plug, and an open plug. These should have the names clearly printed on them, and provided with loops to hang the plugs up at the test box. The patching cords, or cut-through cords as they are sometimes called, should have the plugs numbered. The plug at one end called No. 1 and the other No. 2. The reason of this will be shown later. At some test points a cord and plug connected to a good ground will be needed. This plug should be marked and the cord long enough to permit the plug to be placed in any toll line test jack.

The circuit numbers should be clearly marked on the test boxes, either by a des-

Toll Line Testing Equipment.

Test Panel Switchboard		10 Line Line
27 S		27 S
27 N		27 N
64 E		64 E
107 S		107 S
107 N		107 N
145 S		145 S
180 N		180 N
1	27 S (107 Pha.)	2
1	145 S	2

RAPID CITY EXCHANGE.

No. 10 Vacuum Arresters

27 N		27 S
107 N		145 S
180 N		64 E

1 No. 4 Test Desk.
1 Short Plug.
1 Open Plug.
4 Cut Through Cords.
1 Ground Plug and Cord.

Cords and Plugs hung on Test Box.

ignation strip, or by painting the numbers on the box. It is also a good scheme at such places to paint the line numbers on the arrester strip. Then the operator can be called on to change fuses when necessary.

All testing apparatus at small exchanges must be maintained in good working order. A bad patching cord is a poor thing to put into a circuit when trying to make a measurement. Have all cords inspected and tested at frequent intervals. The test telephone is frequently robbed of parts, and the batteries allowed to dry out, so that the set is not of much use. Keep all your testing equipment 100 per cent efficient.

Phantom Coil Connections.

Where phantom circuits are built up on existing lines there are two general methods of connecting the coils to the lines. One way is to wire cords and plugs directly to the coils. The plugs are then inserted in the line and switchboard jacks respectively. This has two objections. The first is that in testing a line it is necessary to pull out a plug, and this destroys the phantom. The second is that if a phantom is taken down for trouble, there are four plugs to put back to restore the circuit to normal. And there are just as many changes of putting the plugs in wrong.

A second method which is in general use is shown in Fig. 2. In this plan the phantom repeating coils are wired to extra jacks on the test panel. These jacks are numbered 1 and 2 for each physical line. Testing on the normal line testing jacks does not disturb the phantom circuit. To remove the phantom a cut-through cord is used, and Plug No. 1 inserted in Jack No. 1 for Line No. 27 and Plug 2 in Jack, and the same for Line No. 145. This removes the phantom from service. To restore the circuit, simply remove the plugs.
FIG. 2.

Trouble Staff Organization.

The organization of a trouble staff will vary with each organization. One point, however, is important. The trouble men must learn the habit of keeping in touch with the toll test desk at certain periods. Failure to do this should be checked up very promptly.

Another point to remember: When a trouble report is received, send out to the trouble man whose services will possibly be needed, to call the wire chief. Then proceed to make the trouble location. It is very aggravating to spend some time making a troublesome location, only to find that the trouble man needed had just gone out on other work.

Voltmeter Circuit.

To find out quickly the condition of any line some kind of a voltmeter and testing circuit are needed. In Fig. No. 4 is given a circuit which has all the usual features to be found. The open test and the automatic dial keys are possibly exceptions. The high resistance voltmeter is used to determine poor insultation conditions, also the continuity of any circuit. A shunt key bridges a shunt coil across the voltmeter, and then

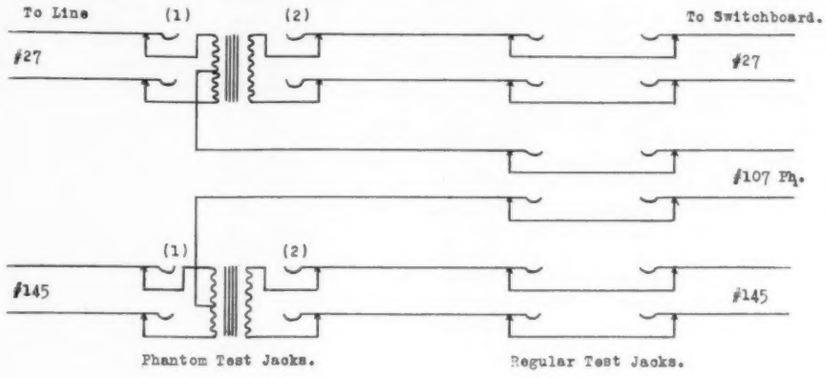


Fig. 2

it may be used to measure the value of resistance.

The value of the voltmeter resistance is usually written on the scale card, such as 10,000 ohms or 100,000 ohms. Where the resistance of the meter is not shown the Wheatstone bridge or an ohmmeter can be used to measure it. Use a low voltage battery in doing this to prevent over-heating the coils, or breaking the needle. We will suppose we have a 10,000 ohm voltmeter, and we wish to add a shunt coil to give a joint resistance of 400 ohms. To find the resistance needed, proceed as follows:

Voltmeter resistance, 10,000 ohms.
Shunt resistance, M ohms.
Joint resistance, 400 ohms.

Now the joint resistance will be less than the value of either of the resistances. So we cannot add in the ordinary way, and get $10{,}000 + M$ ohms. We must set our question down like this.
FIG. 4

$$\frac{1}{10{,}000} = \frac{1}{M} + \frac{1}{400}\ \text{Mho.}$$

The lowest common multiple of 10,000 and $M = 10{,}000\ M$.

Therefore $$\frac{M + 10{,}000}{10{,}000\ M} = \frac{1}{400}$$

Cross Multiply.

$$10{,}000\ M = 400\ M + 40000000$$

Carry the 400 M to the other side of the equation and we have,

$$10{,}000\ M - 400\ M = 40000000$$

Subtract, and

$$960\ M = 40000000$$

Or

$$1\ M = \frac{40000000}{9600}$$

$$= 40000000$$

$$= 416.66\ \text{ohms.}$$

Then the value of the shunt coil will be 416.66 ohms. Coils wound to specific resistance can be supplied by manufac-

(*Continued on page 38*)

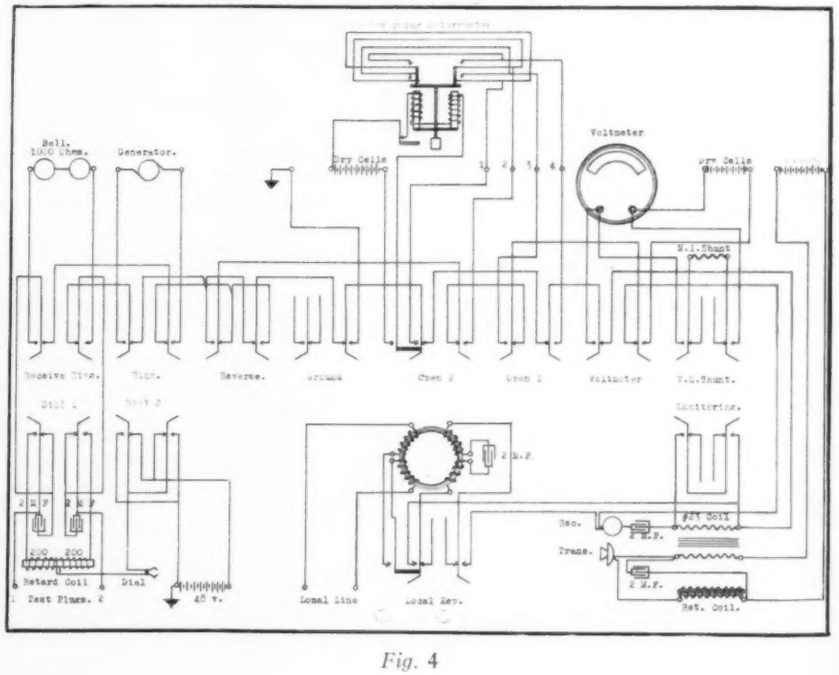


Fig. 4

Sprinkler Alarm System Connected With Telephone Cable in Ingenious Way

By E. R. COLLINS

Where automatic sprinkler systems are used to protect buildings from fire damage, it is the usual custom to have an electric and also a mechanical alarm to indicate that the sprinkler heads have blown.

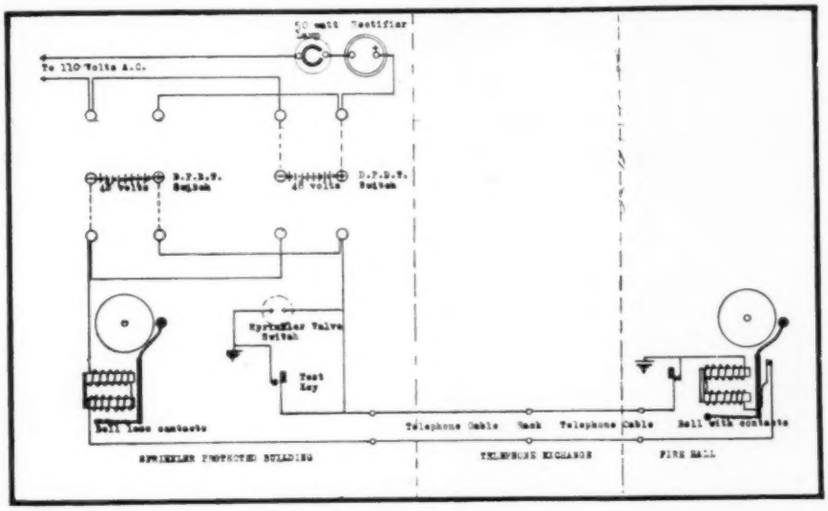
The mechanical alarm is usually located outside the protected building, and is a large bell operated by a water motor arrangement. When water flows into the sprinklers it causes the large bell to ring. The electrical alarm is operated by a valve controlled by the falling of the air pressure in the sprinkler pipes. The electric circuit is usually run to the local fire department, and will give an alarm when the air pressure is released from the sprinkler pipes.

In this particular installation the owner of the building required the use of the telephone cables to build up the circuit. He objected to the usual rental for a battery line from the telephone exchange batteries. There were three alternatives in this case for current supply, dry batteries, storage battery, or bell ringing transformer. The dry batteries were eleminated as they were short in life, and unreliable. The bell ringing transformer, while it would work all right, was objected to because the commercial power might be interrupted just when it was required. There was also the danger of transformer insulation break down, allowing a dangerous current to get into our cables.

Storage batteries were adopted as most economical and reliable. Two sets of Willard C. B. R. 48 volt, 4500 mill amp. radio "B" batteries were used. These were connected with two double pole throw switches, so that either battery could be charged or connected to the system.

A No. 2 Willard colloid rectifier connected in series with a 50 watt lamp to the 110 volt A. C. commercial supply, will recharge the battery in 36 hours if fully discharged. However, once a week the battery which has been in service is charged for 8 hours to keep it in good shape. This provides a very convenient and economical method of charging. The batteries are placed in the basement, where it is cool, and prevents undue evaporation of the electrolyte.

The bell at the fire hall has the usual vibrating contacts. A push button is also set in the cover of the bell as shown in the drawing. The bell at the protected building has no contacts, and will not ring unless the bell at the fire hall rings. A test key is provided at the sprinkler valve so that the electrical circuit can be tested twice daily without operating the air valve.



When testing the system the operator knows that the bell at the fire hall is ringing if the bell at the sprinkler end is ringing. The fire hall also rings back an O.K. Ring, and can prove that the complete circuit is O.K. by their bell ringing.

The resistance of the bells may have to be specified to suit the length of cable over which the system is used. In this case we used bells wound to 20 ohms resistance, with the loop of the cable 40 ohms.

Kewanee, Ill.—Northern Illinois Telephone Co. is rebuilding practically a quarter of its outside plant here this year.

OUR LITERARY DIGEST

Review of Recent Publications on Telephony and Allied Subjects.

Discussion on Depreciation, Depreciation Reserve and Depreciation Fund. Herdrich & Boggs, Indianapolis.

The authors of the booklet are public accountants who have specialized in utility accounting. They have made rather an extended survey of the practices of various commissions and the Interstate Commerce Commission in the matter of requiring a depreciation fund to be set up in cash. In forty states the answer was "No," while in five states it was "Yes." There is rather an extended discussion of the various questions such as ownership of depreciation reserve, transfer of reserve when property is sold and the proper accounting of the reserve in various circumstances. In a general way, the conclusions of the study are that an allowance for retirement of units of property should be included in operating expenses; the depreciation reserve as shown on the balance sheet should not be deducted in determining fair present value; the money received by reason of the depreciation allowance is property of the utility and the utility may expend such money for additions and betterments to its property, in which case property so purchased must be included in the rate base or it may invest the money in high grade securities and the revenue therefrom shall not be considered part of the return on the fair present value unless such assets shall have been considered in fixing the rate base.

Telephony's 1926 Directory of the Telephone Industry

The 1926 edition of "Telephony's" Directory of the telephone industry is out. For 31 years, this has been the standard guide and reference book of its field, and the new issue continues, per custom, to excel its predecessor in value and convenience. All of the telephone exchanges of America, both Bell and Independent, are listed, with their postoffice address. The chief executive and operating officials are named and the approximate number of subscribers are indicated in the case of the Independents, as well as the character of their equipment. The various telephone associations and state commissions are another worth-while feature. The entire book is so well arranged that maximum usefulness for the ensuing year is assured.

Telephone Communication Systems, by R. G. Kloeffler

This book may properly be described as a companion volume to Telephone Communication by C. A. Wright and A. F. Puchstein reviewed in the December

1925 number of this journal. In the Wright-Puchstein book, the authors limited themselves to a discussion of the application of what they termed "medium frequency" currents and thus omitted all discussion of telephone switching systems. The present book is devoted largely to the principles of the telephone and of the various switching systems by which telephone lines are connected. The first four chapters are devoted to an introduction and to the transmitter, the receiver and signalling systems. Succeeding chapters cover the magneto telephone system, non-multiple, multiple, universal, multi-office and automatic feature common battery systems. Telephone protective devices, intercommunicating systems, telephone lines and central office power and testing systems each receive a chapter. A chapter is given each to the Strowger and the panel type, subscriber operated systems, and the book closes with brief chapters on vacuum tubes, repeater and carrier current systems and radio telephony.

Professor Kloeffler has in mind the needs and abilities of the average student in electrical engineering and develops the text along lines that will give an understanding of the principles of the systems without going into unnecessary details or without attempting to describe the multitude of variations that occur. He selects a typical system and discusses the principal features without burdening his text with minor details or unimportant differences in construction or operation. Instructors in electrical engineering schools who have found it necessary to struggle along without suitable text books in telephone practice now have available an excellent book for an introductory course to be followed later by Wright and Puchstein or some of the other texts for more advanced students who have a definite bent for telephony.

World's Largest Office Building to Take Graybar Name

New York City—The new 30-story Graybar building, largest office building in the world, will be located adjacent to the Grand Central Terminal, facing Lexington avenue between 43rd and 44th. The building will occupy over an acre and a half of ground and will be ready for occupancy May 1, 1927. The entire New York executive offices and staff of the Graybar Co. will move to its new quarters at that time.

New York Appropriation for Year Passes 36 Million

The New York Telephone Co. has authorized the expenditure of $2,609,875 for new construction. This brings the total appropriations since January 1 to $36,515,243, of which $31,971,566 was set aside for the enlargement of plant facilities in the metropolitan area.

Talking "Movies" Perfected, State Western Electric Engineers

New York City—Scientific developments which will revolutionize the presentation of motion pictures in the largest metropolitan theaters as well as the earliest theaters in the little towns have just been announced as perfected by the Western Electric Co. and Warner Bros. Pictures, Inc. These developments, it is said, will make it possible for every performance in a motion picture theater to have full orchestration accompaniment to the picture regardless of the size or character of the house. A corporation has been formed to record the synchronization of music for motion picture producers all over the world and to distribute the invention among theater owners.

The apparatus by which combined films and sound records will be reproduced in motion picture theaters is no more complicated from the standpoint of operation than an ordinary motion picture projector. No special skill or technique is required of the operator. If the film breaks, there is no interference with the accuracy of synchronization. The sound record is not controlled by the firm itself.

The system represents successful combination and conversion to motion picture use of three major research developments.

The first of these is the electrical system of recording. This method employs a high quality microphone of an improved type, electrical amplifying apparatus, and a record-cutting mechanism. Recording may be carried on at considerable distance from the source of sound so that the actors may be grouped naturally in any scene and need not be crowded before a microphone.

The second essential feature is a remarkable electrical reproducer which converts the movements of a needle in the grooves of a sound record into electrical vibrations. The electrical currents from this device pass into an amplifier and then operate a high quality loud speaker of an improved type capable of filling practically any motion picture auditorium.

The third development is the link between the reproducer and the audience in a theater. An adaptation of the public address system makes it possible to pick up electrical vibrations from the reproducer, amplify them, and by means of properly located loud speaking telephones transform them into sound. The loudness is so regulated as to give the illusion that the source is the actors whose pictures appear on the screen. In the case of musical programs a specially constructed loud speaking telephone insures the correct values and naturalness.

The combination of these three factors in a complete and effective system required the development of a mechanism for keeping the film and sound producing instrument in absolute synchronism both during recording and during reproduction. It was essential that the system be capable of easy operation in a theater, without requiring special skill. To meet these requirements, both the film and the sound device are set in their respective machines with a given marker in the proper place and the two machines are then speeded up from rest, together, by the simple device of having them coupled to the opposite ends of the same motor.

The mechanism for taking the pictures with these markers on the original film and record could not be accomplished in so simple a manner, since the camera had to be left free to be moved about on its tripod to change the angle of view. In this case two motors are used, one to drive the camera and one to drive the sound recording machine. An ingenious electrical gearing device has been developed whereby the two machines can be started from rest and maintained in synchronism not only after they are up to speed but during the period while they are speeding up.

It was necessary in developing the system to perfect a method of making sound records which will run at least fifteen minutes without distortion either of the high or of the low notes. Through the use of two reproducing machines alternately, interruption in the accompaniment will be avoided. Reproduction in the theater preserves the correct relationship of each sound to the others, the intensity varying in the same proportion as in the enacted scene or musical program.

An important use of the new system will be in providing musical programs for motion pictures already taken. This is accomplished by projecting the picture in the usual way and recording the music, as previously cued, in synchronism with the projection instead of in synchronism with the photographing. Any picture which has ever been produced can be orchestrated and synchronized. The sound synchronization is not dependent on recording at the time of the exposure of the film.

The difficulties of accurate synchronization which had been encountered in earlier attempts lay in the necessity for keeping the artists close to the recording equipment in order that a satisfactory reproduction might be made. The new process of electrical recording makes it possible to make faithful reproductions at a distance from the source of sound.

LINE AND DESK

HOW ESTIMATES ARE MADE

There are two kinds of estimates, routine and specific. The routine estimates are the ones made every quarter of the year to cover the installing and removal of telephones and the making of minor plant changes. The specific estimates are those for larger jobs, an estimate for every job.

The next question logically is, what are estimates for? It seems to me they serve three purposes:

First, an estimate provides a means for the study and authorization of the work before it is undertaken.

Secondly, it provides a basis for checking the completed work against the authorization, both as to cost and to extent.

Thirdly, it provides a record of the entire transaction which will be valuable for reference purposes and for special studies of various kinds.

Because it involves future service and future costs, double vigilance is required in planning new plant. Once constructed, it cannot readily be changed. For this reason it is not red tape to make plans for even a little of plant. It is just good business for our company—good business to have thoroughgoing, careful and detailed estimates.

Taking up the two kinds of estimates, it may be well first to speak of routine estimates. It is, of course, impractical to foresee and obtain advance approval for every telephone installation and other small pieces of work that constantly are coming up, but it is possible to estimate quite accurately the cost of this work for three months in advance, by means of past experiences and careful forecasts. A routine estimate, then, is a blanket authorization for all of this kind of work for a division for three months. A routine estimate is safeguarded by the fact that the detail pieces of work must be approved by the plant engineers, district plant chief, and the division superintendent of plant, or, in some cases, by the chief engineer.

The specific estimates cover specified work and include complete detailed plans, cost estimates and statements of the necessity for doing the work. Estimates prepared by plant engineers for outside plant and for magneto central office equipment must be approved by the division superintendent of plant and by the general superintendent of plant. Estimates for buildings and for common battery central office equipment are prepared by engineers in the chief engineer's department.

All estimates must be approved by the chief engineer, vice-president and general manager and the president, and authorized by the executive committee of our company.

So far, we have gotten only a general view of this estimate machine. Suppose we step a little closer now, where we can see the wheels go around. One of our people learns that somebody is about to open a new addition to one of our cities. His first thought is that we will have to have some telephone plant in it, so he tells the district engineer about it. The district engineer finds out all about it and obtains a map of it. Then he talks it over with the commercial manager to see how much telephone service will be required and when.

It may be decided that it will build up rapidly and that we should plan cable in it as soon as possible. The district engineer then must check his fundamental plan to see how it should be served and must find out whether any plant is now available to serve it according to requirements. If not, perhaps there is some other plant near it which will serve the purpose for a few years until it becomes economical to change to the proper ultimate feed. Having found present facilities to which the new cable might be connected, it is necessary to see whether it has enough spare pairs. If not, it may be necessary to look for a different route for serving or to include some relief cable back toward the office. In determining this, it may be necessary to have the commercial department make an estimate of growth for some larger area than that covered by the proposed new plant, to see how many of the spare pairs will be needed for the territory which they are already serving.

Having settled these points, he is about ready to make his detail plans, preliminary to preparing the estimate. The estimate consists of five parts:

1. The authorization sheet, giving a summary of the principal charges, a brief but accurate and convincing statement of the necessity for the work and other pertinent facts, and space for the required approvals.

2. The sheets containing the detailed estimates of cost for each class of plant to be placed and removed, and associated maintenance charges.

3. An estimate map showing in a general way the plant to be built and removed, with existing plant, cable capacities and loads, plans for future relief where they have an important bearing on the case, and notes that may be helpful in seeing why this plan has been chosen rather than some other.

4. An outline of plan or statement giving information or data that is not included in the authorization sheet, estimate map or detail plans, but is necessary to a thorough review of the plans or estimate.

5. A copy of the complete detail plans which are later to be used by the construction forces in carrying out the work.

This outline covers a rather simple case; others are more complicated. It is necessary to give the most careful consideration to each and every estimate as it comes along.—F. J. Rupe in "The Northwestern Bell."

WHAT DO YOU THINK OF THIS SOLDERING HUNCH?

Dear Sir:

Have just finished reading Ray Blain's soldering article in the June TELEPHONE ENGINEER and learned considerable. You certainly know what you are talking about.

But I would like to take issue with you on one point. When I started in the business about 26 years ago I was taught to make a good mechanical connection and then solder well. But I found that many connections made with rosin solder looked good when they were not good.

Now in most telephone work there is no mechanical strain on the joint. Furthermore a pin point connection is good if solid, while 6 square inches is poor if loose. So I have adopted and insist that my men follow the plan of so making connections that they cannot be solid unless soldered. We so bend the wire that its tension will hold it against the lug or in the hole while soldering. When the joint is cold a little bending makes a good test that prevents rosin joints from creeping in.

What do you think? If there is any real objection to this plan I would be glad to know it.

W. V. SYLVESTER.

Seattle, Wash.

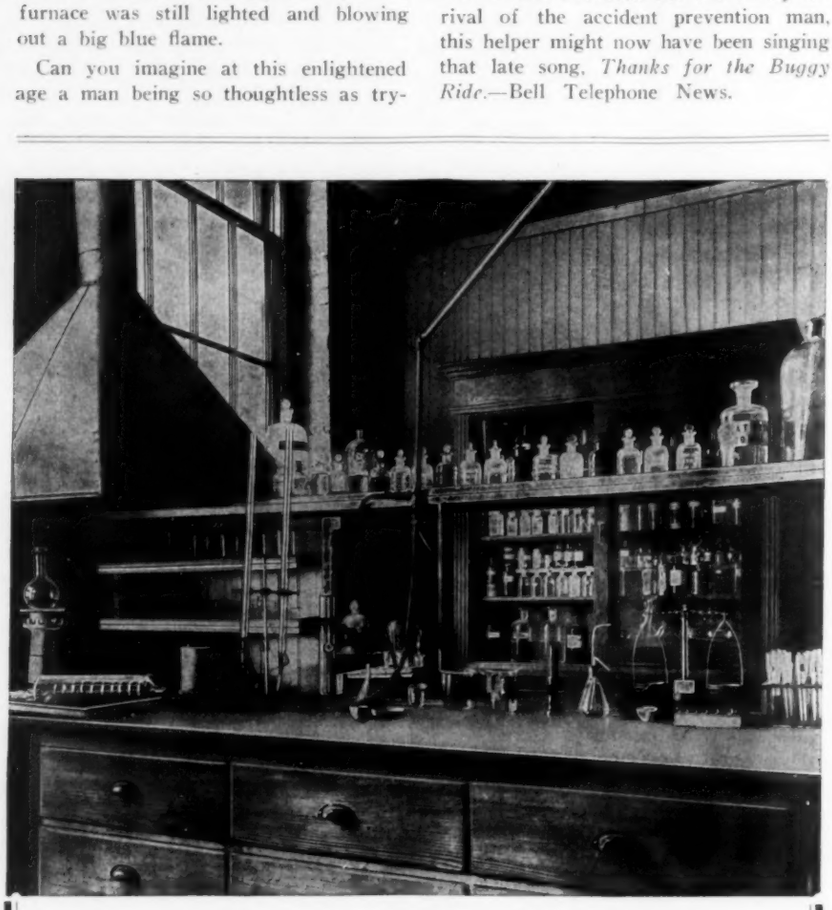
AT LEAST ONE FUNERAL WAS POSTPONED.

A few days ago a representative of the Safety Bureau passed a manhole where a telephone cable splicer and his helper were working, and, much to his surprise, he saw the helper pouring kerosene out of a can into the kerosene furnace. "What's so funny about that?" you may ask. That is just it—it wasn't funny at all to the safety man for the furnace was still lighted and blowing out a big blue flame.

Can you imagine at this enlightened age a man being so thoughtless as trying to pour a highly inflamable substance, such as kerosene, into a furnace which is still lighted and red-hot?

Well, Mr. Accident Prevention Man promptly and politely advised the young fellow of the dangers. The helper then put out the furnace and made himself an improvised funnel of a piece of paper and thanked the safety representative for his warning.

If it had not been for the timely arrival of the accident prevention man, this helper might now have been singing that late song, *Thanks for the Buggy Ride*.—Bell Telephone News.



A corner in the Runzel-Lenz testing laboratory.

Made to last longer by every aid from science and skill!

FOR the quarter century Runzel-Lenz have been making telephone cords our testing laboratory has been an important part of our plant.

Every item of material going into Runzel-Lenz cords, and every detail of construction, is subjected to exacting tests. Innumerable times material and methods that are "good enough" have been discarded when something better has been brought to light by our constant research.

This expert carefulness of ours is assurance that each Runzel-Lenz cord you buy has a pre-determined superiority of service guaranteed by the accurate testing methods of our laboratory.

Standardize Runzel-Lenz cords and you cut cord costs to the minimum.

RUNZEL-LENZ ELECTRIC MFG. CO.
1751 North Western Ave. CHICAGO

BUGS I HAVE SHOT.

Man installing a rural telephone in the winter with snow banked around the house in addition to usual surrounding of leaves boarded up at the foundation.

Placing of the ground rod being rather difficult, a supposed desirable location was selected and attempt made to drive the rod. It failed to start, due as man supposed, to frost in ground. He thereupon secured a large sledge, had the subscriber hold the rod and after two or three healthy blows the rod suddenly disappeared, much to their surprise.

Investigation disclosed that the rod had been driven through the cellar door and had gone down below.—Contributed.

PUNCTUALITY

Did you ever have the boss call you aside and ask you if you would try to get around on time in the morning? And when you started to stutter and offer some excuse about the street cars being tied up, or the alarm clock did not ring, or you had trouble with your car, or some old one like that, and then he said: "Well, if you don't think you can, I'll get someone in your place who will." Didn't you feel rather small when you stopped to think about it?

Folks, tardiness is merely a habit, and a bad one for anyone to have; so, if the germ has settled in your system, get rid of it as soon as you can. It may mean your job, some day, or you might miss out on a big opportunity, just because the other fellow kept the appointment on time.

Suppose you had an appointment in another city, and you could just make it by taking a certain train, and when you got down to the station, the train was a half-hour late because the engineer forgot to get up in time; I'll bet you would like to have that engineer by the neck.

I'll never forget the time when I was in the fifth grade; we had a pennant which was awarded each week to the class which had a perfect attendance record. (The prize that went with the pennant was Friday afternoon off). It happened that the fifth grade had held this pennant for three consecutive weeks, and up to Thursday of the fourth week. Everything was lovely until Friday morning, when school started one seat was empty, and about nine-fifteen the delinquent came strolling in. Nothing was mentioned about it until noon, and then we washed his face in every snowbank in the vicinity.

How would you like it if you were the owner of a large business, and you had about 2,000 employes, and about half of them came late every morning. If it were only one minute, that would mean 1,000 minutes, or 16 hours and 40 minutes; if your average wage scale was 50 cents per hour, it would mean about

$8.24 each day, and inside a year you could buy a nice car with that much.

I had a friend who worked for a big corporation, and was considered an expert in his line. His work was always excellent, but he couldn't figure out why he didn't get a raise when the rest of the fellows did. I asked him if he got to work on time, and he said: "No, I don't have to. I turn out just as much work as the next fellow, so it isn't necessary." I asked him to try it for a month and see what would happen. He took my advice and got his raise.

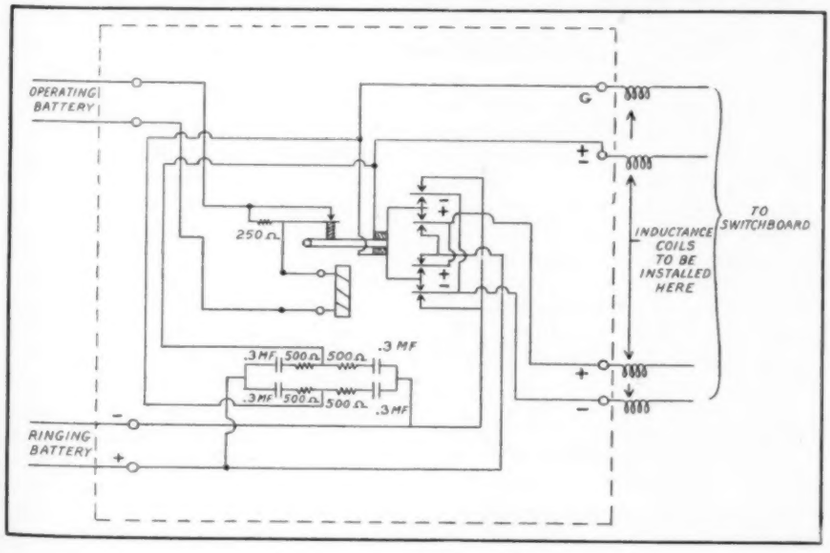
When a man hires you to work a certain number of hours each day and you agree on a certain wage, give him all you promised. Don't try to slip something over because "It can't be done."—"Jimmy" McGrath, Installation Deskman in The Rochester Telephone Bulletin.

RADIO INTERFERENCE REDUCER CIRCUIT.

An Iowa subscriber sends us the following request:

"Kindly advise how to connect condensers, and size of same, to a pole changer to avoid interference with radio reception. We use a type——machine."

The connection diagram is the machine as shown in the accompanying figure. Ordinarily, no additional condensers are used to reduce radio interference from this type of pole changer. The combination of .3 mf condensers and 500 ohm resistances shown near the bottom of the drawing are part of the regular equipment furnished. Usually, the addition of retardation coils in the lines from the machine to the switchboard will reduce the interference to a point where no trouble will be experienced. These coils may be made at home by winding about 250 turns of No. 18 or No. 20 ga. insulated wire on a form about two inches in diameter. A better way, however, is to purchase coils from the maker of your machine who has developed special coils which will do the work, at a very low cost. We would suggest that you take the matter up with the maker. The coils should be mounted as close to the terminals of the machine as possible, the leads from the machine to the coils not being over three inches in length. If only alternating current is used, the coils shown at the + and — pulsating terminals can be omitted.



WHAT DO YOU RECALL OF "'WAY BACK WHEN"?

Do you remember, in the good old days, when competition in the telephone business ran wild, when our main object was not to give telephone service but to put a competitor out of business or prevent him from going into business, either in opposition to us in our own local field or anywhere else? Do you remember the money we spent and the methods we used to accomplish our aims?

In 1904 I was superintendent of the New Long Distance Telephone Company, of Indianapolis, the strongest independent company in the state, owning the principal toll lines connecting the other independent companies of Indiana with Indianapolis and with independent companies in adjacent states. At that time the Central Union Telephone Company purchased The United Telephone Company, an independent company operating in several counties in the northeastern part of the state, with its main exchange at Marion, Indiana. This placed our competitor in control of the exchange where our toll lines terminated. I was sent by my company to Marion to obtain a franchise for an independent company. This was before the advent of the Public Service Commission, when we had to have authority from a city before we could operate a property therein. I seemed to be making headway until the night came when the council was to act finally upon my petition for a franchise.

On arriving in the city, I was surprised to find a neat placard, about eighteen inches square, printed on both sides of which was the following wording: "One telephone company is enough for any city." They were hanging from trees, posts and fences, so that no one could fail to read them. The Central Union Telephone Company was opposing my application for a franchise and had spent considerable money in advertising and placarding the city. I did not get my franchise.

However, on the very next night the Central Union's application for a franchise was to be acted upon by the city council of Franklin, Ind., where there was no Bell plant but where the Franklin Telephone Company, one of the strongest independent companies in the state, was giving service. As I was opposing the application of the Central Union at Franklin, I concluded to use their ammunition in my fight at Franklin. After my defeat at Marion, I spent a considerable portion of the night going about the city gathering up the placards the Central Union Telephone Company had used.

The next night at Franklin the Central Union Company was present in force. In the evening before the council meeting, I had taken the placards gathered at Marion and had them hung on trees, posts and fences all over Franklin. When the matter of franchise came up and I was given an opportunity to present my side of the case, I held up one of the placards, turning it so that the council and the audience could read on both sides that "one telephone company is enough for any city." I told them who had printed the cards, how I had obtained them, and that if one telephone company was enough for Marion, as the council seemed to believe and as the Central Union Telephone Company insisted, one company was surely enough for Franklin. The argument seemed to be complete, for very promptly the council denied the application of the Central Union for a franchise.

I am very glad that we do not do things that way now, that those days of inconsistency are past. I am also glad that instead of wasting our time, money, and energy in trying to drive somebody else out of business, we are using all of our time, energy and money to build up and strengthen telephone properties, so as to give the public the service which is due it and for which it pays.—C. S. N.

Lake Worth, Fla.—Southern Bell has bought the Lake Worth Telephone Company, which has 575 stations.

St. Paul, Ind.—Local telephone exchange, recently destroyed by fire, has been rebuilt.

ITEMIZES BRAIN AND BRAWN TO SATISFY CUSTOMER

We have often felt that our rights as citizens were not being considered when certain specialists in different branches of work rendered their bill for services performed. But would we consider these charges anything at all if we had the following happen to us: A car belonging to a large firm refused to run so a mechanic was called in, looked the car over, tapped it with a hammer a couple of times, and the car ran. When asked what the bill would be he replied that the charges were one hundred dollars. The superintendent was astounded and demanded an itemized bill and as a result received the following:

Tapping with hammer.....$ 1.00
Knowing where to tap..... 99.00

Total $100.00

—The Relay.

Scotia Telephone Co. Covers Nine Missouri Counties

The Scotia Telephone Co., a recently organized telephone company incorporated for $250,000 in Missouri, has purchased the telephone plants belonging to the Eldon Local & Long Distance Tel. Co., Versailles Telephone Co., Festus Telephone Co., Commercial Telephone Co. and Advance Telephone Co., operating exchanges listed above and covering nine counties in Missouri. P. Kerr Higgins, who was president and general manager of all these properties, will be president and general manager of the Scotia Telephone Co.

R. R. Stevens, Independent Veteran, Dies

St. Paul, Minn.—R. R. Stevens, for a number of years associated with Independent telephone companies in Ohio and Minnesota, died here May 25, following a long illness. He was general commercial superintendent for the Ohio properties that formed the Ohio State Telephone Co., and for five years prior to August 1, 1922, was general commercial superintendent for the Tri-State T. and T. Co. at St. Paul. Following his resignation from the Tri-State he became president of the Northern Building and Loan Co., at St. Paul.

F. A. Ketcham to Be Honored by University of Michigan

New York City—The Colleges of Engineering and Architecture of the University of Michigan has conferred on Frank A. Ketcham, Executive Vice-President of the Graybar Electric Co., the degree of Bachelor of Science in Mechanical Engineering, as of the Class of 1897.

Wire Statistics of World Issued by Bell

New York City—Chief statistician's division of the Bell comptroller's department has compiled and issued "Telephone and Telegraph Statistics of the World," as of January 1, 1925. Telephone development by countries and cities, communications, wire distribution and other statistical phases have been covered in this pamphlet. Enlisting the co-operation of private and government owned foreign companies made the compilation of the world-wide statistics possible.

International T. & T. Increases Capital Stock One-Half

New York City—International Telephone and Telegraph Corp. will issue, at the par value of $100 per share, additional shares of the capital stock of the Corporation equal to 50 per cent of the amount outstanding, July 27, 1926. The new stock will be offered to stockholders of record July 27th in the proportion of one share for each two shares registered in their names on the record date. Subscribers may pay 100 per cent September 1, 1926, receiving full paid subscription receipts exchangeable for stock certificates, on or after October 1, 1926, at the National City Bank of New York; or may make a first payment of 30 per cent September 1, 1926, completing their payment either in one installment of 70 per cent November 1, 1926, or in two installments of 30 per cent and 40 per cent November 1, 1926, and January 1, 1927. Interest adjustments will be made by the corporation at the rate of 6 per cent per annum at the time of the final payments.

Vermont Holds Its Sixth Annual Telephone Convention

The sixth annual convention of the Telephone Association of Vermont was held June 29-30 at Burlington, Vt., with 165 delegates registered. About 79 Independent companies in Vermont represented at the meeting more than 22,000 telephones. The directors newly chosen are: C. D. Cushing of Bethel, F. Harding Chessmore of Jonesville, A. W. Foote of Middlebury, C. L. Speare of West Corinth, F. W. Story of Boston, Mass., M. W. Hicks of Granville, N. Y., C. L. Ovitt of Enosburg Falls, J. F. Alexander, Jr., of Saxtons River, and C. M. Goodrich of Northfield.

WANT TO BUY

Telephone Exchange, of from 400 to 600 stations.

Henry Zeitner, Tripp, So. Dak.

(Continued from page 30)

turers, or if you have the material and a means of measuring, you can do it yourself. The shunt coil for the same meter to give 200 ohms would be 204.08 ohms. Work it out and see.

If we wish to measure the resistance of a coil or a line, set up the connection as in Fig. 3 and proceed as follows:

1. Read the voltmeter with a short on the test plugs and suppose the reading is 60.

2. Read the voltmeter with line or coil connected to the test plugs, and suppose reading is 40.

3. Subtract 40 from 60 equals 20.

4. Multiply the difference, 20, by 400, the resistance of the meter and shunt, equals 8000.

5. Divide 8000 by 40 reading of line and we have 200.

Then we know that the resistance of the line or coil is 200 ohms, regardless of the condition of the voltmeter battery.

Open Test

The voltmeter open test is operated on this principle. If we charge a condenser or a line with battery, the current flows out when charging. Then when a circuit is presented it will flow in the reverse direction when discharging. Now if we charge the line with a voltmeter in series with the battery, we get a kick of the voltmeter. If we quickly reverse our voltmeter circuit we will catch the discharge of the line going through the voltmeter in the same direction as the charging current. This will prevent the needle from falling back. If we provide a reversing relay vibrating at an even frequency, we can make the voltmeter hold steady while reading the value of a capacity. Thus we have a means of measuring the capacity of broken wires. This will be referred to under open test. This open test is connected into the voltmeter circuit by operating keys "Open 1" and "Open 2."

The local line connected into the talking circuit provides a convenient way of answering local calls for the wire chief. This can be done without interfering with the testing in progress. The circuit is shown arranged for a common battery line.

The two automatic dial keys are wired for operating automatic switching trunks, using the simplex method. This makes provision to supply battery or ground. It is general practice to supply battery from the distant end to operate automatic trunks over long lines, while for short lines the battery is fed through the automatic trunk.

Chicago, Ill.—With 340 trunk lines and more than 3,800 telephones the private exchange of the new Stevens Hotel here will be the largest in the world, it is claimed.

Wind Shield Insures Efficient Operation in all Kinds of Weather.
Patented Large Non-Heating Valve Wheel
Removable Burner Block Orifice cannot be enlarged
Patented Furnace Type Burner, Greater Heat and Continuous Operation
Easily Removable Needle Cleans Burner Orifice Every Time Valve Is Opened or Closed
Large Pressed Steel Drip Cup Brazed to Supply Pipe
Clevis
Angle Handle Restful and Easy to Hold
Filler Plug on Top Easily Filled No Chance for Dirt to Enter
Handle Support Does Not Extend Through Tank
Pump Has Double Check Valve. Second Held in Place by Clevis
Flared Base for Greater Stability
Steel Tank with Bottom and Three Connections Only Brazed. Every Tank Tested to 100 lbs. Pressure
Three Thicknesses of Steel Where Greatest Wear Takes Place

Look into this new WALL

"Service with Safety"

DREADNAUGHT

This new steel torch combines all the advantages of the time-tried older Dreadnaughts with a number of improvements. Built for heavier work, to give a bigger, hotter flame. New burner cleans itself automatically. All joints brazed with hard brass spelter solder; every torch tested. Can be used in all kinds of weather. A better "service with safety" torch that has been adopted by many of the largest public utility companies. Let us tell you more about the new Dreadnaught No. 41.

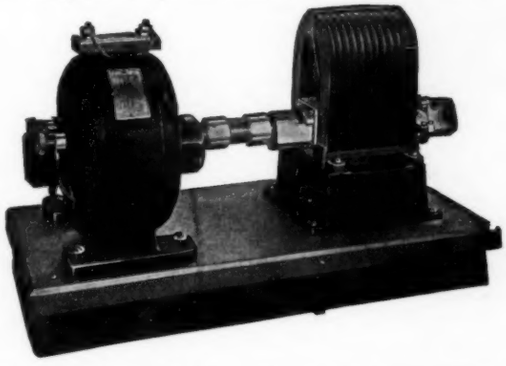
P. WALL MFG. SUPPLY CO.

3126-66 Preble Ave., N. S. PITTSBURGH, PA., U. S. A.

Since 1864

Generators vs. Batteries

Is your ringing service dependable and constant?



The Holtzer-Cabot Electric Company's Magneto Ringing Motor Generator

does its work under any and all conditions, without variation.

It never fails. No battery exhaustion; no battery renewals; no contact adjustments—but constant service.

The Holtzer-Cabot Electric Co.

125 Amory St., Boston, Mass

6161 So. State St., Chicago, Ill.

For Maximum Service—Baker Contact Points

DEPENDABILITY and long life are the two essentials in a contact point. This "heart of the machine" should function evenly and steadily over long periods of time—it should not need replacement at frequent intervals.

Baker Contact Points are made with this principle always in mind and the name "Baker" assures that perfect performance, without constant renewal, which is the outstanding characteristic of a *good* contact point. Our contacts are made of Platinum, Iridio-Platinum, Silver and Special Alloys. There are sizes and types for all purposes.

BAKER & CO., INC.

54 Austin St., Newark, N. J.

NEW YORK CHICAGO

Bell's Billion Capital Stock Is America's Greatest

New York City—The American Telephone and Telegraph Co., which since 1924 has led all corporations in amount of stock outstanding, has announced an offering of stock to shareholders which when sold will send its outstanding share capitalization above the billion-dollar mark. The stock offered to the approximately 370,000 shareholders amounts to $154,000,000, which after subscription will bring the total of American telephone capital stock outstanding to $1,075,597,500.

Only once before has any company had an outstanding share capitalization in excess of $1,000,000,000. At its organization in 1901 the United States Steel Corporation had common and preferred stock outstanding to a total of $1,018,583,600. Common and preferred stock of United States Steel now outstanding total $868,583,600.

The $154,000,000 of additional American Telephone stock will be offered to shareholders of record June 8 in the ratio of one share of additional stock for every six shares then held, at par of $100.

Ashtabula's New Home Makes Newspaper Feature

Ashtabula, Ohio—Opening of the new headquarters building of the Ashtabula Telephone Co. was featured in several pages of a recent issue of the Star-Beacon. Details of the equipment of the new building were given at length, and a number of the suppliers of material and equipment used in the construction of the new plant joined in advertising their participation in the achievement. An interesting story told of the work of moving the telephone equipment into its new home.

The new telephone building is said to be one of the most beautiful buildings in this section of the state. Its completion was marked by inspection visits made by a number of local commercial and civic organizations.

Walter Gallon Elected Wisconsin President at Seventeenth Convention

Here Are Some of the Natables Who Made Badger Meeting a Success

Madison, Wis.—A demonstration of the new "talking movies" held for the seventeenth annual convention of the Wisconsin State Telephone association served to emphasize the advancement made by the telephone industry during its first fifty years which were reviewed and study by a representative attendance of telephone men and women from all parts of the state.

Walter J. Gallon, Antigo, was elected president at the convention succeeding John A. Pratt. Other officers elected:

J. E. Horsman, Rice Lake, vice-president and W. L. Smith, Neillsville, secretary-treasurer.

John Pratt, the retiring president, considered the lessons of the first fifty years of the telephone in making his presidential address. He dwelt upon the matter of rates in the body of his address and in commenting on the more than one hundred rate increase cases pending before the commission said that prices for service must continue until they reach a level which will adequately support the industry.

Wisconsin being the scene of some lively development in the extension of electric service to farms, the matter of interference naturally received considerable attention. It was treated in the paper on "Flood Lighting Farms," by John N. Cady, secretary of the Wisconsin Utilities association and in the address of Lewis E. Gettle, chairman of the Wisconsin Railroad commission on "Relative Rights and Liabilities of Public Utilities in Public Highways." Interference with radio reception also was referred to in the Gettle address.

"Build so you can pay dividends," was the advice given the Badger State men by H. O. Seymour, former general manager of the Wisconsin Telephone company and now vice-president of the First National Bank of Milwaukee.

He paid tribute to the association as the only means of building the union and harmony so vital to the welfare of the industry. Harmony prevails between the Independents and Bell in Wisconsin, according to the remarks of J. E. Horsman, secretary and general manager of the Barron County Telephone company, Rice Lake, who spoke on "The Telephone in Northern Wisconsin." He also lauded the work of the Railroad commission. Mr. Horsman told the highlights of the development of his company and revealed its details of safe and sane management as the foundation of its success.

Insurance received expert consideration, being treated by Charles F. Rupprecht speaking on "History, Science of Rating, Use and Occupancy," and by Joseph Callendar who spoke on "Casualty and Allied Lines."

The plans being successfully followed by telephone companies to educate the public were outlined by F. M. McEniry, general commercial superintendent of the Wisconsin Bell in discussing "Telephone Service from the Customer's Viewpoint."

At no time during the history of the telephone business has there been the bright prospect for young men in the industry that exists today, according to Stanley Edwards, editor of Telephony. This was one of the many close-up observations presented in the interesting address of the well-known journalist whose talk on "Assembled in Convention" gave many good pointers on the general condition of the telephone business and the conduct of a convention that justifies itself. He commented on the changing fashions of the last 15 years so far as conventions were concerned.

President MacKinnon of the U. S. I. T. A. and J. F. Krizek, general attorney of the Wisconsin Telephone company spoke at the Fiftieth Anniversary luncheon over which Walter J. Gallon presided. Mr. Krizek spoke in a general way on management and its rewards. He stated that the problems of competition are now in the past.

The 9,000 companies comprising the Independent telephone group must exercise utmost vigilance and judgment if their integrity is to be preserved, warned President MacKinnon. He mentioned the danger of telephone consolidations made by outside interests because of the speculative margin present in the power and light fields being absent in the telephone industry.

In considering the relations between the Bell, operating 6,000 exchanges and the Independents, operating 15,000 exchanges, Mr. MacKinnon said:

"It being recognized that two groups are essential, the only question for discussion is how they shall be maintained. The Independent association has set forth in no uncertain terms that it believes that the proper balance between the two groups and a strong Independent group can be maintained only if there be relinquishments to offset purchases by Bell companies.

"The association, by this statement, recognizes the necessity of transfers from one group to the other. In fact, it is because of the recognition that there must be readjustments of territory that the association takes the stand it does, believing that the time has arrived when adjustments must be made on a larger scale for economic and service reasons. It is considered probable that there will be readjustments until both units have been formed into companies operating in contiguous territory instead of scattered units separated by plants owned by members of the other group.

"To develop the two groups properly and retain the relations that must be retained for that development, there must be strict adherence to the stipulated agreements made by the two groups by both agents and principals of the groups.

"One of the difficulties experienced in the past by those responsible as principals has been that the agents—the employes of the companies of both groups—have, through misunderstanding of the letter or the spirit of the agreements, or

(*Continued on page 43*)

(*Continued from Page* 40)

of the intent of the principals, violated the agreements. These violations have led to suspicion and charges of bad faith. These agents have forgotten that 'the principal is bound by the acts of his agent' and that 'the agent is committed by the agreements of his principal.'

"There have been three periods in the development of the telephone industry: First, there was the period of promotion and antagonism between the two groups of the industry; then the period of adjustment of conditions created during the first period; and now the present period of forming permanent lines between the two groups.

"Whether there will be a fourth period depends greatly upon the ability of the two groups to agree upon a procedure and work together amicably. If this cooperation can not be secured, there will be, in all probability, the fourth period—some sort of government operation or ownership.

"The United States Independent Telephone Association is asserting the right of individual initiative that the Independent group within itself has the strength and ability to take care of its companies; that this group will provide necessary Independent buyers for Independent properties; and that only by such independent action can the group continue Independent."

"The manufacturing company is just as much a part of the Independent group as the operating company. We must have our factories and distributing agencies. We must carry clean through to the end as principal and agent those things which the leaders have considered necessary and the manufacturing company, as a part of the Independent group, is included."

"Laws Affecting Women and Minors in the Telephone Industry," were discussed by Taylor Frye, assistant to the Wisconsin Industrial commission, who submitted a schedule of hours for women in telephone exchanges. This schedule and other details of Mr. Frye's address provoke lively comment.

The convention wound up in a technical session during which J. M. Stokerson, La Crosse, spoke on cable and cable trouble, and F. H. Runkel, Portage, told of the importance of pole records and numbering. He recommended branding as the best method of pole numbering.

During the convention an operators' conference, presided over by H. E. Roberts, district traffic supervisor of the Wisconsin Telephone company, was held.

A brisk schedule of social events, including luncheons, dinners, theater parties and golf, featured the lighter hours of the convention. One of the local notables also staged a pleasant affair at his company's lakeside playground for the entertainment of visitors, during which some of the industry's most noted manufacturing and operating changed hands several times on royal flushes, according to the gabby and light-hearted participants.

Southern Bell Absorbs Cumberland

Washington, D. C.—The Cumberland Telephone Company was incorporated into the Southern Bell T. and T. company July 1. The merger involves no change in personnel as both companies have been operated under the same Bell management for a number of years. The combination now has more than 800,000 stations and 21,000 employes.

PHILADELPHIA

CHESTNUT *and* 39*th* STREET ~

Hotel Pennsylvania

Fireproof—Unrestricted Parking

500 Rooms
400 Baths

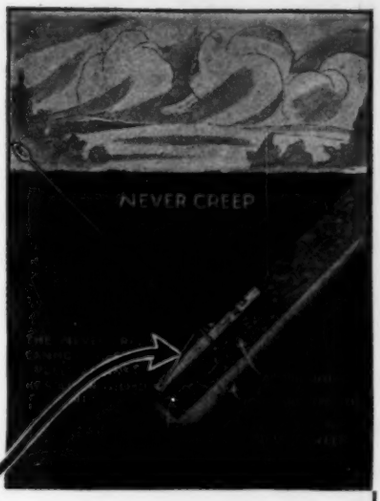
Only half minute from center of activities in very good residential location

Rooms with running water
from $2.50 per day

Rooms with private bath and shower
from $3.00 per day

Food and Service the Best

Near West Philadelphia Station Pennsylvania Railroad



In *Any* Soil

Never-Creep Anchors

Have Superior Holding Power

In sandy, moist, adobe, or any other soils, the great holding surface of the NEVER-CREEP and its pull against solid, undisturbed earth gives an anchorage that is unsurpassed.

The more you look into anchor construction and performance the more you realize that undisturbed earth to pull against is a vital consideration. Tamping very seldom suffices to give the holding condition an anchor needs. Moisture seeps down to the holding plate of the anchor and collects there with a great sacrifice of the anchor's rigidity. You know how these factors ruin holding power, so play safe by standardizing the NEVER-CREEP and get away from the perils that are bound to come when the earth is disturbed during anchor installation.

The NEVER-CREEP alone has the Thimbleye rod.

Foremost wire companies prefer the NEVER-CREEP. So will you when you learn its complete story. Write us for details.

Chance Company
Centralia, Mo.

Made in Canada by
N. SLATER CO., INC.
Hamilton, Ont.

Everstick

Approved by Large Operating Companies For the Following Strains

6" 2-way	2,200 lbs.
6" 4-way	6,000 lbs.
8" 2-way	6,000 lbs.
8" 4-way	10,000 lbs.
10" 4-way	16,000 lbs.

Write for Details

Everstick Anchor Co.
ST. LOUIS, MO.

HK

Hotel Knickerbocker
120-128 West 45th St.

Just East of Broadway, Times Square

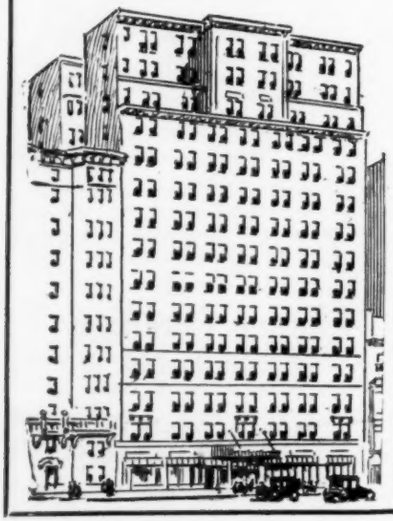
New York's Newest Hotel

A location unsurpassed. A few seconds to all leading shops and theatres. Away from the noise and bustle and still convenient to everything. Between Grand Central and Pennsylvania Terminals.

RATES

$3 to $5 per Day

400 Rooms—400 Baths



Speedy!

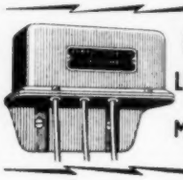
Just loop the wire on and drive. That's the way to install

EUREKA FIBRE INSULATED NAILS

Superior for telephone, telegraph and bell wiring. Uniform, finished appearance. Do not injure woodwork. Furnished in gray or black fibre: polished brass, oxidized or special wire nails; a flexible rubber bushing giving a thick insulation.

Prices and samples on application to

EUREKA SUPPLY CO.
Moorestown, N. J.



CHAPMAN LIGHTNING ARRESTERS
MADE BY MINNESOTA ELECTRIC CO.
MINNEAPOLIS, MINN.

Rice Made W. E. Hawthorne Works Manager

Chicago, Ill.—In the Western Electric's most important organization change of recent months Charles Leslie Rice becomes Works Manager of the Hawthorne Works in Chicago, in charge of all the company's manufacturing functions there. His staff will be headed by S. S. Holmes as assistant works manager. Mr. Rice succeeds to the position formerly held by C. G. Stoll. He was born in Pittsfield, Mass., and was graduated from Agricultural College and Boston University. He joined the company in 1902 and started literally at the bottom. He became chief of the order entering department in January, 1907, and in October of the same year he was made chief of the clerical and production department in New York. In 1911 he went to London to take charge of the company's allied plant there. After three years in England he came to Hawthorne as superintendent of the production branch. In December, 1923, he was made assistant works manager in charge of the production, inspection and clerical branches, the position from which he has just been promoted.

Sac City, Ia.—Sac City Telephone Company has sold its system to J. A. Innes who also operates the exchange at Sloan.

UNIQUE BLOW TORCH

It starts quickly, operates in any position, and produces a remarkable heat. It is a great worker in cold and windy weather.

The automatic orifice cleaner, one of the details shown in the illustration, is but one of a number of exclusive features that make the Unique your greatest value in blow torches.

Painstaking care by interested workmen, an actual "burning test" before shipping, is just another detail responsible for their uniformity and efficient burning qualities.

Write for complete details

Unique Manufacturing Co.
113 N. Desplaines St. CHICAGO, ILL.

RECONSTRUCTED EQUIPMENT

American Elec. 6-bar Extra heavy duty Bdg. hand Generators complete @	$ 2.75
Western Electric Co., No. 2-C Ball type Combine line drops and jacks, per strip of 5 @	7.75
Kellogg No. 3 100 ohm series combine line drops and jacks, per strip of 5 @	6.50
Dean or Garford Combine line drops and jacks, mounted 10 per strip 500 or 1000 ohm, per strip @	11.00
Burns No. 45 Express type Combine line drops and jack @	1.35
Western Elec. Co., 2500 ohm Biased ringers with gongs @	1.60
Am. Elec. Co., No. 360 type 3-bar 2500 ohm 4-party compacts with biased ringers @	6.75
American Elec. No. 36 type 5-bar 1600 ohm Bdg. compacts @	7.50
Chicago Telephone Supply Co., 4-bar 1000 or 1600 ohm Bdg. compacts @	6.75
Stromberg No. 500 4-bar 1000 or 1600 ohm Bdg. compacts @	6.90
Stromberg late type 1000 ohm self contained ringers complete less Gongs @	1.20
Mansbridge ½ M. F. Condensers @	.30
Dean No. 240 type 4-bar 1000 or 1600 ohm Bdg. compacts @	6.90
Garford Pony type 4-bar 1600 ohm Bdg. compacts @	8.50
Monarch 4-bar 1000 or 1600 ohm Bdg. compacts @	7.25
Kellogg No. 39 Unbreakable type C. B. desk sets complete with No. 75 Straight line steel signal sets @	6.75
Auto. Elec. Co., 600 ohm Extension bells @	1.25

REBUILT ELECTRIC EQUIPMENT CO.
Not Inc.
E. C. Stoeffhaas, Mgr.
1940 W. 21st Street CHICAGO, ILL.

We are not connected with or successors to Rebuilt Telephone Equipment Co.

Monarch Common Battery Telephones —For Low Operating Costs

A low operating cost is the desire of every plant owner and manager. Upon these costs depend the efficiency and growth of the plant.

Monarch Common Battery Telephones, either Desk or Wall Type, will help to reduce the cost of maintenance, for they are of the latest design with many new and improved features. They have a permanent black finish, and are so constructed that adjustment and maintenance is easy and inexpensive. They give a better service at a lower operating cost.

Send for our Bulletin No. 52. It tells all about them. Ask our salesman about them when he calls.

Monarch Telephone Mfg. Co.

1027 WEST VAN BUREN ST., CHICAGO, ILL.

Saves money all along the line

THE new Prest-O-Lite Heating Equipment for linemen not only saves money by getting more work and better work done, but it is more economical to operate.

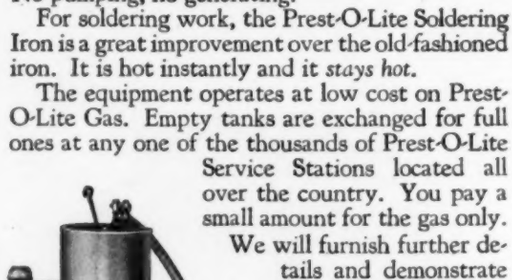
Ready instantly with intense heat and can be carried anywhere. Merely take it to the job, turn on the gas and the kind of heat you want is there. No pumping, no generating.

For soldering work, the Prest-O-Lite Soldering Iron is a great improvement over the old-fashioned iron. It is hot instantly and it *stays hot.*

The equipment operates at low cost on Prest-O-Lite Gas. Empty tanks are exchanged for full ones at any one of the thousands of Prest-O-Lite Service Stations located all over the country. You pay a small amount for the gas only.

We will furnish further details and demonstrate the efficiency of this equipment on request.

THE PREST-O-LITE CO., Inc.
INDIANAPOLIS, IND. Dept. M-8
New York San Francisco
In Canada: Prest-O-Lite Company of Canada, Ltd., Toronto, Ontario



Portable size for pole work

Prest-O-Lite Gas

"The gas of a thousand uses"

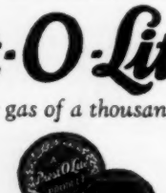


Table of Contents

Editorial 19-20
Collecting from the Service Lines—Sales of Directories—Publicity for Traffic Figures—Confusion in Radio Broadcasting.

Typical Toll Line Troubles and Their Location, by E. R. Collins 21-25

"I," Not "We," Keynote of Dallas Repair Plan 26-28

Magnetism Is Basic Study for Telephone Man—By F. J. Dommerque 29-33

Endless Task Is Goodwill Campaign, by E. L. Gaines 34-38

Line and Desk 40-42
Noxious Gases—No Use for the Handaxe—"Short Out the Ringers"—An Unusual Case of Underground Trouble—Carrier System for Australia—An Interesting Telephone Sign.

Index to Advertisers

Addressograph Co. 43
American Electric Co. 2
American Steel & Wire Co. 46
American Telephone & Telegraph Co. 35
Automatic Electric Co. ..... 1 and 47

Baker & Co. 41
Bell Lumber Co. 38
Blake Signal & Mfg. Co. 46
Brach Mfg. Co., L. S. 41
Braden Co. 14
Buckeye Telephone & Supply Co. 43
Bernz Co. 46

Chance Co. 45
Chicago Solder Co. 39
Coffey System & Audit Co. 43
Contact Metals Co. 43
Cook Electric Co. 18
Copperweld Steel Co. 8

Electric Storage Battery Co. 46
Eureka Supply Co. 45
Everhot Mfg. Co. 37
Everstick Anchor Co. 44

French Battery Co. 15

Graybar Electric Co. 17
Gulf Cross Arm Co. 43

Harrah Mfg. Co. 48
Herdrich & Boggs 43
Holtzer-Cabot Electric Co. 41
Hoover Body Co. 39
Hubbard & Co. 37

Indiana Steel & Wire Co. 39
International Creo. & Con. Co. 3

Johnson, J. K. 43

Kellogg Switchboard & Supply Co. ..... 4 and 5
Klein & Sons, Mathias 43
Knickerbocker Hotel 44

Matthews Corp., W. N. 12
Meredith, W. C. 46
Minnesota Electric Co. 45
Monarch Telephone Mfg. Co. ..... 8 and 9

National Cable Compound Co. 41
National Carbon Co. 11

Peiffer, P. 41
Premier Electric Co. 41
Prest-O-Lite Co. 10

Rebuilt Electric Equipment Co. 45
Reliable Electric Co. 16
Roy-Jax Co. 46
Runzel-Lenz Elec. Mfg. Co. 42

Seguin, J. J. 43
Standard Underground Cable Co. 46
Stewart Bros. 46
Strebl, W. C. 43
Stromberg-Carlson Tel. Mfg. Co. ..... 6 and 7
Suttle Equipment Co. 43

Texas Creosoting Co. 13

Unique Mfg. Co. 45
Universal Specialty Co. 43

Wray & Co., J. G. 43